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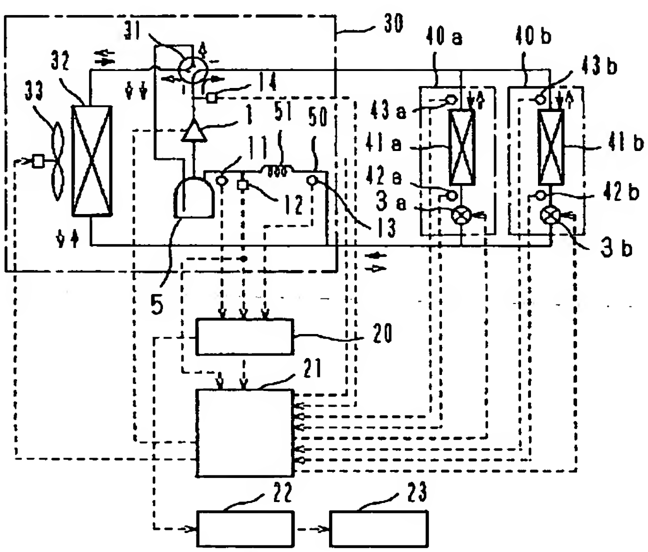
* NOTICES *

Epitome

(57) [Abstract]
[Objects of the Invention] Even if the refrigerant presentation of the non-azeotropy mixing refrigerant which circulates through the inside of a refrigerating cycle changes, the frozen air conditioner in which the always optimal operation is possible is obtained.
[Elements of the Invention] A compressor 1, a four way valve 31, the 1st heat exchanger 32, the 1st expansion valve 3a and 3b and the 2nd heat exchanger 41a and 41b, and an accumulator 5 are connected, and a refrigerating cycle is constituted. The 1st heat exchanger 32 and piping between the 1st expansion valve 3a and 3b, Connect an accumulator 5 for the bypass piping 50 through the 2nd expansion valve 51, and the coolant temperature of the temperature of the refrigerant of the outlet section of the 2nd expansion valve 51, a pressure, and the inlet-port section of the 2nd expansion valve 51 is detected. While calculating the refrigerant presentation which circulates through the inside of a cycle with the presentation computing element 20, according to the circulation presentation detected by this presentation computing element 20, the operation-control control unit 21 of a refrigerating cycle performs.

[Translation done.]



3 a, 3 b：第1膨張弁　　32：室外熱交換器
22：比較演算器　　41 a, 41 b：室内熱交換器
23：警報装置　　50：バイパス配管
31：四方弁　　51：第2膨張弁

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] In what connects a compressor, a condenser, an expansion valve, and an evaporator, and constitutes a refrigerating cycle, using a non-azeotropy mixing refrigerant as a refrigerant The 1st thermometric element which detects the coolant temperature of the evaporator inlet-port section, the pressure sensor which detects the refrigerant pressure of the above-mentioned evaporator inlet-port section, From the signal detected with the 2nd thermometric element and the 1st thermometric element which detect the coolant temperature of the condenser outlet section, the above-mentioned pressure sensor, and the 2nd thermometric element The frozen air conditioner using the non-azeotropy mixing refrigerant characterized by having the presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle, and the control unit which performs the operation control of the above-mentioned refrigerating cycle according to the refrigerant presentation detected by this presentation computing element.
[Claim 2] In what connects a compressor, a condenser, an expansion valve, and an evaporator, and constitutes a refrigerating cycle, using a non-azeotropy mixing refrigerant as a refrigerant The thermometric element which detects the coolant temperature of the evaporator inlet-port section, the pressure sensor which detects the refrigerant pressure of the above-mentioned evaporator inlet-port section, The presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle from the signal detected with the above-mentioned thermometric element and the above-mentioned pressure sensor, And the frozen air conditioner using the non-azeotropy mixing refrigerant characterized by having the control unit which performs the operation control of the above-mentioned refrigerating cycle according to the refrigerant presentation detected by this presentation computing element.
[Claim 3] In what connects a compressor, a condenser, an expansion valve, an evaporator, and an accumulator, and constitutes a refrigerating cycle, using a non-azeotropy mixing refrigerant as a refrigerant The thermometric element which detects the coolant temperature between the above-mentioned accumulator and compressor inhalation piping in an accumulator, The pressure sensor which detects the refrigerant pressure between the above-mentioned accumulator and compressor inhalation piping in the above-mentioned accumulator, The presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle from the signal detected with the above-mentioned thermometric element and the above-mentioned pressure sensor, And the frozen air conditioner using the non-azeotropy mixing refrigerant characterized by having the control unit which performs the operation control of the above-mentioned refrigerating cycle according to the refrigerant presentation detected by this presentation computing element.
[Claim 4] In what connects a compressor, a condenser, an expansion valve, an evaporator, and an accumulator, and constitutes a refrigerating cycle, using a non-azeotropy mixing refrigerant

as a refrigerant From the signal detected with an oil-level detection means to detect the oil level of the above-mentioned accumulator, and this oil-level detection means The frozen air conditioner using the non-azeotropy mixing refrigerant characterized by having the presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle, and the control unit which performs the operation control of the above-mentioned refrigerating cycle according to the refrigerant presentation detected by this presentation computing element.

[Claim 5] The thing which is characterized by providing the following and which connects a compressor, a four way valve, the 1st heat exchanger, the 1st expansion valve, and the 2nd heat exchanger, and constitutes a refrigerating cycle, using a non-azeotropy mixing refrigerant as a refrigerant Piping between the 1st heat exchanger and the 1st expansion valve Bypass piping which connects inhalation piping of the above-mentioned compressor through the 2nd expansion valve, The 1st thermometric element which detects the coolant temperature of the outlet section of the 2nd expansion valve, the pressure sensor which detects the refrigerant pressure of the outlet section of the 2nd expansion valve, From the signal detected with the 2nd thermometric element and the 1st thermometric element which detect the coolant temperature of the inlet-port section of the 2nd expansion valve, the above-mentioned pressure sensor, and the 2nd thermometric element The presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle, and the control unit which performs the operation control of the above-mentioned refrigerating cycle according to the refrigerant presentation detected by this presentation computing element

[Claim 6] The thing which is characterized by providing the following and which connects a compressor, a four way valve, the 1st heat exchanger, the 1st expansion valve, and the 2nd heat exchanger, and constitutes a refrigerating cycle, using a non-azeotropy mixing refrigerant as a refrigerant Piping between the 1st heat exchanger and the 1st expansion valve The presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle from the signal which detected with bypass piping which connects inhalation piping of the above-mentioned compressor through the 2nd expansion valve, the thermometric element which detect the coolant temperature of the outlet section of the 2nd expansion valve, the pressure sensor which detect the refrigerant pressure of the outlet section of the 2nd expansion valve, the above-mentioned thermometric element, and the above-mentioned pressure sensor, and the control unit which perform in the operation control of the above-mentioned refrigerating cycle according to the refrigerant presentation detected by this presentation computing element

[Claim 7] The frozen air conditioner using the non-azeotropy mixing refrigerant according to claim 5 or 6 characterized by preparing the heat exchange section which performs heat exchange for bypass piping for the 1st heat exchanger and piping between the 1st expansion valve.

[Claim 8] The frozen air conditioner using the non-azeotropy mixing refrigerant according to claim 1 to 7 characterized by establishing the comparison-operation means which emits an alarm signal when the refrigerant presentation detected by the presentation computing element separates from the predetermined range, and an alarm means to operate with the alarm signal which this comparison-operation means emits.

[Translation done.]

2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the configuration of the frozen air conditioner with which dependability operates highly and efficiently, even when especially a refrigerant circulation presentation differs from an initial restoration presentation about the frozen air conditioner which used the non-azeotropy mixing refrigerant.
[0002]
[Description of the Prior Art] Drawing 22 shows the configuration of the frozen air conditioner using the conventional non-azeotropy mixing refrigerant shown in JP,61-6546,A. In drawing, for a compressor and 2, as for an expansion valve and 4, a condenser and 3 are [1 / an evaporator and 5] accumulators, and piping connects with a serial, and these constitute a frozen air conditioner, and use the non-azeotropy mixing refrigerant which consists of a high-boiling point component and a low-boiling point component.
[0003] In the frozen air conditioner constituted as mentioned above, the refrigerant gas of elevated-temperature high pressure compressed with the compressor 1 is condensate-ized with a condenser 2, is decompressed by the expansion valve 3, serves as a low-pressure vapor-liquid two phase refrigerant, and flows into an evaporator 4. This refrigerant evaporates with an evaporator 4, returns to a compressor 1 through an accumulator 5, is compressed again, and is sent into a condenser 2. Moreover, the accumulator 5 has prevented the liquid return to a compressor 1 by collecting the surplus refrigerants generated according to the service condition and load conditions of a frozen air conditioner.
[0004] By using the non-azeotropy mixing refrigerant set by the purpose as a refrigerant, with the single refrigerant, low evaporation temperature or higher condensation temperature is obtained, or it is known for such a frozen air conditioner from the former that the advantage of cycle efficiency improving more will be acquired rather than it was not obtained. Moreover, since refrigerants used widely, such as R12 and R22, cause ozone layer depletion from the former, the non-azeotropy mixing refrigerant is proposed as these alternative refrigerants.
[0005]
[Problem(s) to be Solved by the Invention] Since the frozen air conditioner using the conventional non-azeotropy mixing refrigerant is constituted as mentioned above, if the service condition and load conditions of a frozen air conditioner are fixed, the refrigerant presentation which circulates through the inside of a refrigerating cycle is fixed, and constitutes a refrigerating cycle with the above sufficient effectiveness. However, when a service condition and load conditions change and the amount of refrigerants stored especially in an accumulator changes, the refrigerant presentation which circulates through the inside of a refrigerating cycle changes, and adjustment of the refrigerant flow rate by control of the refrigerating cycle according to this circulation refrigerant presentation, i.e., the revolving speed control of a compressor, opening control of an expansion valve, etc., is needed. However, in the conventional frozen air conditioner, since a means to detect this circulation refrigerant presentation was not established, there was a trouble that the optimal operation according to a circulation refrigerant presentation was unmaintainable. moreover, refrigerant leakage of a refrigerating cycle in use -- or also when a circulation refrigerant presentation changed by malfunction at the time of refrigerant restoration, the abnormalities of this circulation refrigerant presentation could not be detected, but there was a trouble that a frozen air conditioner with high safety and dependability was not obtained.
[0006] It was made in order that this invention might cancel the above troubles, and even if the refrigerant presentation which circulates through the inside of a refrigerating cycle changes, it aims at obtaining the frozen air conditioner which enabled operation of the always optimal

refrigerating cycle.
[0007]
[Means for Solving the Problem] The frozen air conditioner using the non-azeotropy mixing refrigerant concerning claim 1 of this invention In a compressor, a condenser, an expansion valve, and the thing that connects an evaporator and constitutes a refrigerating cycle While forming the presentation computing element which calculates the temperature of the refrigerant of the evaporator inlet-port section, a pressure, and the refrigerant presentation that detects the coolant temperature of the condenser outlet section and circulates through the inside of a cycle, the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element is formed.
[0008] The frozen air conditioner using the non-azeotropy mixing refrigerant concerning claim 2 of this invention forms the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element in a compressor, a condenser, an expansion valve, and the thing that connect an evaporator and constitute a refrigerating cycle while forming the presentation computing element which calculates the refrigerant presentation which detects the temperature and the pressure of a refrigerant of the evaporator inlet-port section, and circulates through the inside of a cycle.
[0009] The frozen air conditioner using the non-azeotropy mixing refrigerant concerning claim 3 of this invention In what connects a compressor, a condenser, an expansion valve, an evaporator, and an accumulator, and constitutes a refrigerating cycle While forming the presentation computing element which calculates the refrigerant presentation which detects the temperature and the pressure of a refrigerant between an accumulator and compressor inhalation piping in an accumulator, and circulates through the inside of a cycle The control unit which performs control of a compressor or an expansion valve according to the circulation presentation detected by this presentation computing element is formed.
[0010] The frozen air conditioner using the non-azeotropy mixing refrigerant concerning claim 4 of this invention forms the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element in what connects a compressor, a condenser, an expansion valve, an evaporator, and an accumulator, and constitutes a refrigerating cycle while forming the presentation computing element which calculates the refrigerant presentation which detects the oil level of an accumulator and circulates through the inside of a cycle.
[0011] The frozen air conditioner using the non-azeotropy mixing refrigerant concerning claim 5 of this invention In what connects a compressor, a four way valve, the 1st heat exchanger, the 1st expansion valve, and the 2nd heat exchanger, and constitutes a refrigerating cycle Connect the 1st heat exchanger, piping between the 1st expansion valve, and inhalation piping of a compressor for bypass piping through the 2nd expansion valve, and the coolant temperature of the temperature of the refrigerant of the outlet section of the 2nd expansion valve, a pressure, and the inlet-port section of the 2nd expansion valve is detected. While forming the presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle, the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element is formed.
[0012] The frozen air conditioner using the non-azeotropy mixing refrigerant concerning claim 6 of this invention In what connects a compressor, a four way valve, the 1st heat exchanger, the 1st expansion valve, and the 2nd heat exchanger, and constitutes a refrigerating cycle Connect the 1st heat exchanger, piping between the 1st expansion valve, and inhalation piping of a compressor for bypass piping through the 2nd expansion valve, and the temperature and the pressure of a refrigerant of the 2nd expansion valve are detected. [of the outlet section] While forming the presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle, the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element is formed.
[0013] The frozen air conditioner using the non-azeotropy mixing refrigerant concerning claim 7

of this invention prepares the heat exchange section which performs heat exchange for bypass piping in the frozen air conditioner of claims 5 or 6 for the 1st heat exchanger and piping between the 1st expansion valve.

[0014] The frozen air conditioner using the non-azeotropy mixing refrigerant concerning claim 8 of this invention establishes the comparison-operation means which emits an alarm signal when the circulation presentation detected with the presentation computing element separates from the predetermined range to each above-mentioned frozen air conditioner, and an alarm means to operate with the alarm signal which this comparison-operation means emits.

[0015]

[Function] In claim 1 of this invention, the coolant temperature of the temperature of the refrigerant of the evaporator inlet-port section, a pressure, and the condenser outlet section is detected for the refrigerant presentation which circulates through the inside of a compressor, a condenser, an expansion valve, and the refrigerating cycle that connected the evaporator, and a detection value is inputted into a presentation computing element, and is calculated. Since it is inputted into a control unit and control values according to a refrigerant circulation presentation, such as a compressor and an expansion valve, are determined, the refrigerant circulation presentation which the presentation computing element detected can make the optimal operation of a frozen air conditioner possible, when a circulation presentation changes by change of the service condition of a frozen air conditioner, or load conditions, or even when a circulation presentation changes by refrigerant leakage frozen air-conditioner in use and malfunction at the time of refrigerant restoration.

[0016] In claim 2 of this invention, only the temperature and the pressure of a refrigerant of the evaporator inlet-port section in the above-mentioned refrigerating cycle are inputted into a presentation computing element, and with a presentation computing element, the dryness fraction of the refrigerant which flows into an evaporator calculates a refrigerant presentation, assuming that it is a predetermined value. Therefore, the same thing as the above-mentioned equipment is realized by the easy equipment configuration.

[0017] In claim 3 of this invention, in the refrigerating cycle which connected a compressor, the condenser, the expansion valve, the evaporator, and the accumulator, the coolant temperature and pressure between the above-mentioned accumulator and compressor inhalation piping in an accumulator are detected, a detection value is inputted into a presentation computing element, and with a presentation computing element, the dryness fraction of the refrigerant which flows into an accumulator calculates a refrigerant presentation, assuming that it is a predetermined value. Therefore, like the above-mentioned equipment, by the easy equipment configuration, even when a circulation presentation changes, the optimal operation of a frozen air conditioner can be enabled.

[0018] In claim 4 of this invention, the oil level of an accumulator is detected and a refrigerant presentation is calculated from the height of the oil level investigated beforehand, and the relation of a circulation presentation with the presentation computing element which inputs a detection signal into a presentation computing element. Therefore, like the above-mentioned equipment, by the easy equipment configuration, even when a circulation presentation changes, the optimal operation of a frozen air conditioner can be enabled.

[0019] In claims 5 and 6 of this invention, in the refrigerating cycle which connected a compressor, a four way valve, the 1st heat exchanger, the 1st expansion valve, and the 2nd heat exchanger, bypass piping which connects the 1st heat exchanger, piping between the 1st expansion valve, and inhalation piping of the above-mentioned compressor through the 2nd expansion valve is prepared, a thermometric element and a pressure sensor are formed here, and a refrigerant presentation is calculated. With such a configuration, since the downstream of the 2nd expansion valve will always be in a low-pressure two phase condition, the temperature detected with the same detector and a pressure show a refrigerant presentation irrespective of air conditioning and heating.

[0020] In claim 7 of this invention, the heat exchange section is prepared in bypass piping, the enthalpy in which the flowing refrigerant has bypass piping is transmitted to the refrigerant which flows a process line, and an energy loss is prevented.

[0021] When the refrigerant circulation presentation which the presentation computing element detected separates from the predetermined range appointed beforehand in claim 8 of this invention, in order judge this with a comparison-operation means and to operate an alarm means, while the circulation presentation of a non-azeotropy mixing refrigerant uses it, can change by refrigerant leakage, or it can detect certainly that a circulation presentation changed by malfunction at the time of refrigerant restoration, and it becomes that offer of a frozen air conditioner with high safety and dependability is possible.

[0022]

[Example]

The example of this invention is explained about drawing below example 1. Drawing 1 shows the 1st example of the frozen air conditioner concerning this invention, 1 constitutes the refrigerating cycle, when an evaporator and 5 are [a condenser and 3] accumulators as for an electric-type expansion valve and 4 and a compressor and 2 connect these to a serial by piping, and the opening of the electric-type expansion valve 3 is controlled by the output signal of a control unit 21. This refrigerating cycle is filled up with the non-azeotropy mixing refrigerant which consists of high-boiling point component R134a and a low-boiling point component R32.

[0023] In the inlet-port section of an evaporator 4, it is the coolant temperature T1. The 1st thermometric element 11 and the refrigerant pressure P1 to detect The 1st pressure sensor 12 to detect is formed, respectively, and it is the coolant temperature T2 in the outlet section of a condenser 2. The 2nd thermometric element 13 to detect is formed and the detecting signal of these detectors 11, 12, and 13 is inputted into the presentation computing element 20. Moreover, the 2nd pressure sensor 14 which detects that refrigerant pressure is formed in regurgitation piping of a compressor 1, and the detecting signal of this detector 14 is inputted into a control unit 21 with the detecting signal of a detector 13.

[0024] The presentation computing element 20 is the temperature T1 which detectors 11, 12, and 13 detect, a pressure P1, and temperature T2. It has the function for it to be based and to calculate the circulation presentation alpha of a non-azeotropy mixing refrigerant, and the operation value of this circulation presentation alpha is inputted into a control unit 21. moreover, the pressure P2 to which the circulation presentation alpha and a detector 14 detect a control unit 21 from -- the function of calculating the saturated liquid temperature TL in a condensation pressure, and this saturated liquid temperature TL The temperature T2 which a detector 13 detects from -- it has the function calculate whenever [in the outlet section of a condenser 2 / supercooling], and the function which controls the opening of the electric-type expansion valve 3 so that whenever [this supercooling] serves as a predetermined value.

[0025] Next, actuation of this example constituted as mentioned above is explained. The refrigerant gas of elevated-temperature high pressure compressed with the compressor 1 is condensate-ized with a condenser 2, is decompressed by the expansion valve 3, serves as a low-pressure vapor-liquid two phase refrigerant, and flows into an evaporator 4. This refrigerant evaporates with an evaporator 4, returns to a compressor 1 through an accumulator 5, is compressed again, and is sent into a condenser 2. The surplus refrigerant generated according to the service condition and load conditions of a frozen air conditioner collects in an accumulator 5.

[0026] Next, it explains based on the pressure enthalpy chart of the flow chart which shows actuation of the presentation computing element 20 to drawing 2 , and the refrigerating cycle which shows drawing 3 , and the vapor-liquid-equilibrium diagram of the non-azeotropy mixing refrigerant of drawing 4 . In addition, in drawing 3 , a saturated liquid curve [as opposed to the circulation presentation alpha in a continuous line A], a saturated steam curve [as opposed to the circulation presentation alpha in a continuous line B], and a continuous line C are cycle actuation lines, and an alternate long and short dash line is the constant-temperature line. moreover, drawing 4 -- setting -- an axis of abscissa -- the weight fraction of a low-boiling point component, and an axis of ordinate -- temperature and a dotted line -- the pressure of the inlet-port section of an evaporator 4 -- P1 it is -- it is temperature [in / the saturated steam temperature at the time (X= 1), and an alternate long and short dash line, and / in a continuous line / dryness fraction X] (0<X<1). [saturated liquid temperature (X= 0)] Coolant

temperature T1 of the inlet-port section of the evaporator 4 first detected with detectors 11, 12, and 13 at step S1 when actuation of the presentation computing element 20 was started A pressure P1 and temperature T2 of the outlet section of a condenser 2 It incorporates to the presentation computing element 20. Next, at step S2, the circulation presentation alpha in a refrigerating cycle is assumed, and dryness fraction X of the refrigerant which flows into an evaporator 4 under this assumption is calculated in step S3. namely, -- the bottom of the circulation presentation alpha assumed as shown in drawing 3 -- temperature T2 of the outlet section of a condenser 2 from -- Enthalpy H -- it can be found -- pressure P1 of the inlet-port section of an evaporator 4 HL It is obtained and dryness fraction X of the inlet-port section of an evaporator 4 becomes settled uniquely by the degree type in approximation.

[0027]

[Equation 1]

$$X = \frac{H - H_L}{H_V - H_L}$$

[0028] It is HV here. It is the enthalpy of the point that a saturated steam curve and a cycle actuation line cross. They are dryness fraction X, temperature T2, and a pressure P1 in fact. Relation is beforehand memorized in the presentation computing element 20, and they are temperature T2 and a pressure P1. Dryness fraction X is computed using a value. further -- step S4 -- dryness fraction X of the inlet-port section of this evaporator 4, the coolant temperature T1 of the inlet-port section of an evaporator 4, and pressure P1 Circulation presentation alpha* It calculates. That is, the temperature and the pressure of a non-azeotropy mixing refrigerant in the vapor-liquid two phase condition that a dryness fraction is X become settled with the circulation presentation which flows the inside of a refrigerating cycle as shown in drawing 4 . Therefore, by using the property shown by the drawing 4 solid line, it is circulation presentation alpha*. It is calculable. At step S5, it is this circulation presentation alpha*. If the circulation presentation alpha assumed first is compared and both are in agreement, a circulation presentation can be found as alpha. If both are not in agreement, it returns to step S2 and the circulation presentation alpha is reassumed again, and count is continued until both are in agreement.

[0029] Next, it explains using the flow chart which shows actuation of a control device 21 to drawing 5 . When actuation of a control unit 21 is started, at step S1, it is the temperature T2 of the outlet section of a condenser 2 first. Condensation pressure P2 It detects. Next, at step S2, the circulation presentation alpha is incorporated from the presentation computing element 20, and it is the condensation pressure P2 at step S3. The circulation presentation alpha to pressure P2 Saturated liquid temperature TL which can be set It calculates. This saturated liquid temperature TL Since the circulation presentation alpha has become settled, it is a pressure P2. It becomes settled uniquely (refer to drawing 3). further -- step S4 -- T2 TL from -- SC is calculated whenever [refrigerant supercooling / of the outlet section of a condenser 2] (SC=TL-T2). At step S5, whenever [this supercooling], it judges whether SC is in agreement with a predetermined value, for example, 5 degrees C, and when it is judged that it is in agreement with a predetermined value, it shifts to a termination step. Moreover, when it is judged that it is not in agreement with the value of ******, it shifts to step S6 and opening modification processing of the electric-type expansion valve 3 is performed.

[0030] When the circulation presentation in a refrigerating cycle changes with change of the service condition of a frozen air conditioner, or load conditions by repeating the above-mentioned actuation, or even when a circulation presentation changes by refrigerant leakage frozen air-conditioner in use and malfunction at the time of refrigerant restoration, whenever [supercooling / of the outlet section of a condenser 2] is maintained at a proper value, and the always optimal operation of it is attained.

[0031] In addition, as this example, although explained for binary system as a mixed refrigerant, in the case of multicomponent systems, such as three-component system, the same effectiveness can be acquired.

[0032] Moreover, although what controls the opening of the electric-type expansion valve 3 was

explained with the control unit 21 of this example so that whenever [supercooling / of the outlet section of a condenser 2] might be kept constant even if the circulation presentation in a cycle changed the temperature of the outlet section of an evaporator 4 -- detecting -- the circulation presentation alpha and evaporation pressure P1 from -- pressure P1 The saturated steam temperature Tv which can be set is calculated (refer to drawing 3), and even if it controls so that the degree of superheat of the outlet section of an evaporator 4 becomes fixed The optimal operation of a frozen air conditioner can be enabled like the above.
[0033] Furthermore, by this example, the control unit 21 explained what controls the opening of the electric-type expansion valve 3 the optimal, even if the circulation presentation in a cycle changed, but even if it controls the rotational frequency of a compressor 1 according to a circulation presentation, it can acquire the same effectiveness.
[0034] Example 2. drawing 6 shows the 2nd example of the frozen air conditioner concerning this invention, and is the coolant temperature T1 in the inlet-port section of an evaporator 4. The 1st thermometric element 11 and the 1st refrigerant pressure P1 to detect The 1st pressure sensor 12 to detect is formed, respectively, and these detectors 11 and 12 detecting signals are inputted into the presentation computing element 20. Moreover, in the outlet section of a condenser 2, it is the coolant temperature T2. The 2nd thermometric element 13 to detect is formed, and the 2nd pressure sensor 14 which detects the refrigerant pressure is formed in regurgitation piping of a compressor 1, and the detecting signal of these detectors 13 and 14 is inputted into a control unit 21.
[0035] The presentation computing element 20 is a detector 11, the temperature T1 which 12** detects, and a pressure P1. It has the function for it to be based and to calculate the circulation presentation alpha of a non-azeotropy mixing refrigerant, and the operation value of this circulation presentation alpha is inputted into a control unit 21. moreover, the pressure P2 to which the circulation presentation alpha and a detector 14 detect a control unit 21 from -- the saturated liquid temperature TL in a condensation pressure The function to calculate and this saturated liquid temperature TL The temperature T2 which a detector 13 detects from -- it has the function calculate whenever [supercooling / of the outlet section of a condenser 2], and the function which controls the opening of the electric-type expansion valve 3 so that whenever [this supercooling] serves as a predetermined value.
[0036] Next, actuation of the presentation computing element 20 of this example is explained. With the presentation computing element 20, it is the temperature T1 of the inlet-port section of an evaporator 4 first. Pressure P1 It incorporates. The refrigerant which flows into an evaporator 4 is temperature T1 by the dryness fraction's being usually in about 0.1 to 0.3 vapor-liquid 2 condition, and assuming this dryness fraction to be 0.2. Pressure P1 It is only information and the circulation presentation alpha can be presumed. namely, the thing for which the property shown as the continuous line is used into drawing 4 -- temperature T1 Pressure P1 from -- the circulation presentation alpha is calculable.
[0037] In addition, since actuation of a control unit 21 is the same as that of an example 1, explanation is omitted, but in this example, even if it can detect the circulation presentation in a refrigerating cycle and a circulation presentation changes only with the temperature and the pressures of the inlet-port section of an evaporator 4, whenever [supercooling / of the outlet section of a condenser 2] is maintained at a proper value, and the always optimal operation of it is attained.
[0038] In addition, although the set point of dryness fraction X was made about into 0.1 to 0.3 in the above-mentioned example, it is not limited to the above-mentioned value.
[0039] Thus, by constituting, the operation in the presentation computing element 20 becomes easy, and the same equipment as the above can be realized by the easy equipment configuration, and it becomes cheap.
[0040] Example 3. drawing 7 shows the 3rd example of the frozen air conditioner concerning this invention, and is the coolant temperature T1 in an accumulator 5. The 1st thermometric element 11 and the refrigerant pressure P1 to detect The pressure sensor 12 to detect is formed, respectively and the detecting signal of these detectors 11 and 12 is inputted into the presentation computing element 20. The presentation computing element 20 is the temperature

T1 in a detector 11 and the accumulator 5 which 12** detects, and a pressure P1. It has the function for it to be based and to calculate the circulation presentation alpha of a non-azeotropy mixing refrigerant, and actuation of this presentation computing element 20 is explained hereafter.
[0041] Coolant temperature T1 in the accumulator 5 first detected with detectors 11 and 12 in the operation controller 20 Pressure P1 It incorporates. The refrigerant which flows into an accumulator 5 can consider in approximation that a dryness fraction is 0.9, although the dryness fraction is usually in the vapor-liquid two phase condition which is 0.8 to about 1.0. The temperature and the pressure of a refrigerant of this condition become settled with the circulation presentation of the non-azeotropy mixing refrigerant which flows the inside of a refrigerating cycle as shown in drawing 8 . Therefore, they are the temperature T1 in an accumulator 5, and a pressure P1 by using the property shown by the drawing 8 solid line. The circulation presentation alpha can be calculated.
[0042] In addition, although explanation is omitted since actuation of a control unit 21 is the same as that of an example 1, in this example, only with the temperature and the pressure in an accumulator 5, the circulation presentation in a refrigerating cycle can be detected, the operation in the presentation computing element 20 becomes easy like an example 2, it is an easy equipment configuration and the same equipment as an example 1 is obtained cheaply.
[0043] In addition, although this example showed what measures the temperature and the pressure in an accumulator 5, the 1st thermometric element 11 and a pressure sensor 12 may be formed between an accumulator 5 and inhalation piping of a compressor 1. Moreover, although the set point of dryness fraction X was made about into 0.8 to 1.0 in the above-mentioned example, it is not limited to the above-mentioned value.
[0044] Example 4. drawing 9 shows the 4th example of the frozen air conditioner concerning this invention, the oil-level detector 15 which detects the refrigerant oil level of that interior is formed in the accumulator 5, and the signal of this oil-level detector 15 is further inputted into the presentation computing element 20. As this oil-level detector 15, well-known level gages, such as an ultrasonic type level gage and a capacitance type water gauge, are used, for example. The presentation computing element 20 has the function to calculate the circulation presentation alpha of a non-azeotropy mixing refrigerant, based on refrigerant oil-level height h in the accumulator 5 which a detector 15 detects, and explains actuation of this presentation computing element 20 hereafter.
[0045] Initiation of actuation of the presentation computing element 20 incorporates refrigerant oil-level height h in the accumulator 5 first detected with the oil-level detector 15. Generally the refrigerant in the accumulator of a refrigerating cycle using a non-azeotropy mixing refrigerant is divided into the liquid phase which was rich in the high-boiling point component, and the gaseous phase which was rich in the low-boiling point component, and the liquid phase which was rich in the high-boiling point component is stored in an accumulator. For this reason, when liquid cooling intermediation exists in an accumulator, the refrigerant presentation which circulates through the inside of a refrigerating cycle shows the inclination for a low-boiling point component to increase (for a circulation presentation to increase). Drawing 10 is what showed the relation between refrigerant oil-level height h in this accumulator, and the circulation presentation alpha, the refrigerant oil-level height in an accumulator increases, namely, a circulation presentation increases, so that the amount of liquid refrigerants in an accumulator increases. Therefore, if the experiment etc. investigates beforehand the relation shown in this drawing 10 , the circulation presentation alpha can be calculated from refrigerant oil-level height [in the accumulator 5 detected with the oil-level detector 15] h.
[0046] In addition, since actuation of a control unit 21 is the same as that of an example 1, explanation is omitted, but in this example, even if it can detect the circulation presentation in a refrigerating cycle, and an equipment configuration is easy and a circulation presentation changes only with the refrigerant oil-level height in an accumulator 5, whenever [supercooling / of the outlet section of a condenser 2] is maintained at a proper value, and the always optimal operation of it is attained.
[0047] In addition, although the above-mentioned example explained the case where level gages,

such as an ultrasonic type and an electrostatic-capacity type, were used as an oil-level detection means 15, based on the service condition and load conditions of a refrigerating cycle, the amount [surplus / in a cycle] of refrigerants is calculated, and the same effectiveness is demonstrated even if it detects the oil-level height in an accumulator 5. For example, a surplus refrigerant is not generated, but at the time of heating operation, the experiment etc. investigates beforehand that the surplus refrigerant of a certain amount is generated at the time of air conditioning operation, and it may detect the oil-level height in an accumulator 5 by the operation from the relation between this service condition measured beforehand and the amount of surplus refrigerants. Moreover, in this case, information, such as indoor air temperature at the time of air conditioning operation and outdoor air temperature, may be added, and the oil-level detection precision in an accumulator may be raised.

[0048] Example 5. drawing 11 shows the 5th example of the frozen air conditioner concerning this invention, and shows the frozen air conditioner which comes to connect two sets of interior units to one set of an exterior unit. In drawing 11 , 30 is an exterior unit, it consists of a compressor 1 and the four way valve 31, an outdoor heat exchanger (the 1st heat exchanger) 32, an outdoor blower 33, and an accumulator 5, and the 2nd pressure sensor 14 is formed in piping of the discharge side of a compressor 1. 40a and 40b (hereafter, when naming generically, it is 40) are interior units respectively. Indoor heat exchangers 41a or 41b (hereafter, when naming generically, it is 41) (the 2nd heat exchanger), It consists of electric-type expansion valves 3a or 3b (hereafter, when naming generically, it is 3) which are the 1st expansion valve. In the entrance section of the indoor heat exchange machine 41 The 3rd thermometric element 42a and 42b (hereafter, when naming generically, it is 42), and the 4th thermometric element 43a and 43b (hereafter, when naming generically, it is 43) are formed respectively. Moreover, in the middle of piping which connects the electric-type expansion valve 3 in an interior unit 40 with an outdoor heat exchanger 32, the bypass piping 50 which connects this piping and accumulator 5 is formed, and while being this bypass piping 50, the capillary tube 51 which is the 2nd expansion valve is formed. Moreover, the 1st thermometric element 11 and the 1st pressure sensor 12 are formed in the bypass piping 50 at the outlet section of a capillary tube 51, and the 2nd thermometric element 13 is formed in the inlet-port section of a capillary tube 51. In addition, the indoor blower is omitted.

[0049] 20 is a presentation computing element, and the signal of the 1st thermometric element 11 formed in the bypass piping 50, the 1st pressure sensor 12, and the 2nd thermometric element 13 is inputted, and it calculates the refrigerant presentation which circulates through the inside of a cycle. 21 is a control unit and the signal from the circulation presentation signal from the presentation computing element 20 and the 1st pressure sensor 12, the 2nd pressure sensor 14, the 3rd thermometric element 42 in an interior unit 40, and the 4th thermometric element 43 is inputted. In a control unit 21, the opening of the rotational frequency of the compressor [input signals / these] 1 according to a circulation presentation, the rotational frequency of the outdoor blower 33, and the electric-type expansion valve 3 of an interior unit is calculated downward, and the command is transmitted to a compressor 1, the outdoor blower 33, and the electric-type expansion valve 3 downward, respectively. In a compressor 1 and the outdoor blower 33, and the electric-type expansion valve 3, whenever [rotational frequency or valve-opening] drives in response to the command value sent from the control unit 21. Moreover, 22 is a comparison-operation means, a circulation presentation signal is inputted from the presentation computing element 20, and a circulation presentation carries out the comparison operation of whether it goes into predetermined within the limits defined beforehand. The alarm 23 is connected to this comparison-operation means 22, and when a circulation presentation separates from the predetermined range, an alarm signal is transmitted to an alarm 23.

[0050] Next, actuation of this example constituted as mentioned above is explained using drawing 11 and the control-block Fig. shown in drawing 12 . The presentation computing element 20 incorporates the signal from the 1st thermometric element 11 formed in the bypass piping 50, the 1st pressure sensor 12, and the 2nd thermometric element 13, calculates refrigerant dryness fraction X of the inlet-port section of a capillary tube 51 using the relation shown in drawing 3

and drawing 4 , and calculates the circulation presentation alpha in a cycle. In a control unit 21, the rotational frequency command of the optimal compressor 1 according to this circulation presentation alpha, and the rotational frequency command of the outdoor blower 33 and the opening command of the electric-type expansion valve 3 are calculated.

[0051] Heating operation is explained first. At the time of heating operation, it circulates through a refrigerant in the direction of the continuous-line arrow head in drawing 11 , indoor heat exchanger 41 turns into a condenser, and heating is performed. The rotational frequency of a compressor 1 is controlled so that a condensation pressure is in agreement with desired value, and this condensation pressure desired value can be found as a pressure from which for example, the condensation temperature Tc becomes 50 degrees C. If the condensation temperature of a non-azeotropy mixing refrigerant is defined as the average of saturated steam temperature and saturated liquid temperature, the condensation pressure desired value Pc from which condensation temperature Tc becomes 50 degrees C will become settled uniquely with the circulation presentation alpha, as shown in drawing 13 . Therefore, in a control unit 21, the relational expression of drawing 13 is made to memorize beforehand, and condensation pressure desired value calculates using the circulation presentation signal transmitted from the presentation computing element 20. Furthermore, with a control unit 21, according to the difference of the pressure and condensation pressure desired value which the 2nd pressure sensor 14 detects, the adjusted value of the rotational frequency of a compressor 1 calculates by feedback control, such as PID control, and a compressor rotational frequency command is outputted to a compressor 1.

[0052] The rotational frequency of the outdoor blower 33 is controlled so that an evaporation pressure is in agreement with desired value, and this evaporation pressure desired value can be found as a pressure from which for example, the evaporation temperature Te becomes 0 degree C. If the evaporation temperature of a non-azeotropy mixing refrigerant is defined as the average of saturated steam temperature and saturated liquid temperature, the evaporation pressure desired value Pe from which the evaporation temperature Te becomes 0 degree C will become settled uniquely with the circulation presentation alpha, as shown in drawing 14 . Therefore, in a control unit 21, the relational expression of drawing 14 is made to memorize beforehand, and evaporation pressure desired value calculates using the circulation presentation signal transmitted from the presentation computing element 20. Furthermore, with a control unit 21, according to the difference of the pressure and evaporation pressure desired value which the 1st pressure sensor 12 detects, the adjusted value of the rotational frequency of the outdoor blower 33 calculates by feedback control, such as PID control, and an outdoor blower rotational frequency command is outputted to the outdoor blower 33.

[0053] The opening of the electric-type expansion valve 3 is controlled so that whenever [supercooling / of the outlet section of indoor heat exchanger 41] becomes a predetermined value, for example, 5 degrees C. It can ask for whenever [this supercooling] as a difference of the saturated liquid temperature in the pressure in indoor heat exchanger 41, and the temperature of the outlet section of indoor heat exchanger 41, and saturated liquid temperature can be searched for as a function of a pressure and a circulation presentation, as shown in drawing 15 . Therefore, in a control unit 21, the relational expression of drawing 15 is made to memorize beforehand, and saturated liquid temperature and whenever [outlet section supercooling / of indoor heat exchanger 41] calculate using the circulation presentation signal transmitted from the presentation computing element 20, the pressure signal transmitted from the 2nd pressure sensor 14, and the temperature signal transmitted from the 3rd thermometric element 42. Furthermore, with a control unit 21, according to the difference of whenever [supercooling / of this outlet section], and a predetermined value (5 degrees C), the adjusted value of the opening of the electric-type expansion valve 3 calculates by feedback control, such as PID control, and an electric-type expansion valve opening command is outputted to the electric-type expansion valve 3.

[0054] On the other hand, at the time of air conditioning operation, it circulates through a refrigerant in the direction of the broken-line arrow head in drawing 11 , indoor heat exchanger 41 turns into an evaporator, and air conditioning is performed. The rotational frequency of a

compressor 1 is controlled so that an evaporation pressure is in agreement with desired value, and this evaporation pressure desired value can be found as a pressure from which for example, the evaporation temperature Te becomes 0 degree C. If the evaporation temperature of a non-azeotropy mixing refrigerant is defined as the average of saturated steam temperature and saturated liquid temperature, the evaporation pressure desired value Pe from which the evaporation temperature Te becomes 0 degree C will become settled uniquely with the circulation presentation alpha, as shown in drawing 14 . Therefore, in a control unit 21, the relational expression of drawing 14 is made to memorize beforehand, and evaporation pressure desired value calculates using the circulation presentation signal transmitted from the presentation computing element 20. Furthermore, with a control unit 21, according to the difference of the pressure and evaporation pressure desired value which the 1st pressure sensor 12 detects, the adjusted value of the rotational frequency of a compressor 1 calculates by feedback control, such as PID control, and a compressor rotational frequency command is outputted to a compressor 1.

[0055] The rotational frequency of the outdoor blower 33 is controlled so that a condensation pressure is in agreement with desired value, and this condensation pressure desired value can be found as a pressure from which for example, the condensation temperature Tc becomes 50 degrees C. If the condensation temperature of a non-azeotropy mixing refrigerant is defined as the average of saturated steam temperature and saturated liquid temperature, the condensation pressure desired value Pc from which condensation temperature Tc becomes 50 degrees C will become settled uniquely with the circulation presentation alpha, as shown in drawing 13 . Therefore, in a control unit 21, the relational expression of drawing 13 is made to memorize beforehand, and condensation pressure desired value calculates using the circulation presentation signal transmitted from the presentation computing element 20. Furthermore, with a control unit 21, according to the difference of the pressure and condensation pressure desired value which the 2nd pressure sensor 14 detects, the adjusted value of the rotational frequency of the outdoor blower 33 calculates by feedback control, such as PID control, and an outdoor blower rotational frequency command is outputted to the outdoor blower 33.

[0056] The opening of the electric-type expansion valve 3 is controlled so that the degree of superheat of the outlet section of indoor heat exchanger 41 becomes a predetermined value, for example, 5 degrees C. It can ask for this degree of superheat as a difference of the saturated steam temperature in the pressure in indoor heat exchanger 41, and the temperature of the outlet section of indoor heat exchanger 41, and saturated steam temperature can be searched for as a function of a pressure and a circulation presentation like the saturated liquid temperature shown in drawing 15 . Therefore, in a control unit 21, the relational expression of saturated steam temperature, a pressure, and a circulation presentation is made to memorize beforehand, and saturated steam temperature and the outlet section degree of superheat of indoor heat exchanger 41 calculate using the circulation presentation signal transmitted from the presentation computing element 20, the pressure signal transmitted from the 1st pressure sensor 12, and the temperature signal transmitted from the 4th thermometric element 43. Furthermore, with a control unit 21, according to the difference of this outlet section degree of superheat and a predetermined value (5 degrees C), the adjusted value of the opening of the electric-type expansion valve 3 calculates by feedback control, such as PID control, and an electric-type expansion valve opening command is outputted to the electric-type expansion valve 3.

[0057] Next, actuation of the comparison-operation means 22 is explained. The comparison-operation means 22 incorporates a circulation presentation signal from the presentation computing element 20, and it judges whether this circulation presentation is proper circulation presentation within the limits memorized beforehand, and if a circulation presentation is proper circulation presentation within the limits, operation will be continued as it is. the proper circulation presentation this circulation presentation was beforehand remembered to be with the comparison-operation means 22 on the other hand when it changed with refrigerant leakage or a circulation presentation changed by malfunction at the time of refrigerant restoration while the circulation presentation used it -- if it judges with it being out of range, an alarm signal will be

transmitted to an alarm 23. In the alarm 23 which received this alarm signal, predetermined time dispatch of the warning is carried out, and the circulation presentation of the non-azeotropy mixing refrigerant of a frozen air conditioner warns of having separated from the proper range.
[0058] As mentioned above, in what is shown in this example, since the downstream of the 2nd expansion valve will always be in a low-pressure two phase condition irrespective of air conditioning and heating, at the time of air conditioning, temperature and a pressure can be measured with the same detector at the time of heating, and a refrigerant presentation can be calculated. Therefore, even if it is not necessary to form a detector according to an air conditioning, and an equipment configuration becomes easy and a circulation presentation changes, the always optimal operation is attained.
[0059] In addition, although that to which the value of the 1st pressure sensor 12 controls the rotational frequency of the outdoor blower 33 at the time of heating operation by this example in agreement with the evaporation pressure desired value calculated from a circulation presentation was explained, a thermometric element is formed in the inlet-port section of an outdoor heat exchanger 33, and the same effectiveness can be acquired, even if it controls so that this temperature serves as a predetermined value (for example, 0 degree C).
[0060] Moreover, although what controls the opening of the electric-type expansion valve 3 at the time of air conditioning operation by this example so that the degree of superheat of the outlet section of indoor heat exchanger 41 serves as a predetermined value (for example, 5 degrees C) was explained, the same effectiveness can be acquired, even if it controls so that the temperature differential of the 4th thermometric element and the 3rd thermometric element serves as a predetermined value so that the entrance temperature gradient of indoor heat exchanger 41 serves as a predetermined value (for example, 10 degrees C) namely.
[0061] Furthermore, by this example, although the frozen air conditioner by which two sets of interior units 40 were connected to one set of an exterior unit 30 explained, it does not restrict to this, and even if three or more sets of that to which one set only of an interior unit was connected, and interior units are connected, the same effectiveness can be acquired.
[0062] Example 6. drawing 16 and drawing 17 show the 6th example of the frozen air conditioner concerning this invention, it is drawing 11 and drawing 16 and the element of the same number shows the same element. At the time of heating operation, it circulates through a refrigerant in the direction of the continuous-line arrow head in drawing 16 , and circulates through it in the direction of a broken-line arrow head at the time of air conditioning operation. In this example, it is only the 1st thermometric element 11 and the 1st pressure sensor 12, and the signal inputted into the presentation computing element 20 assumes refrigerant dryness fraction X which flows into the capillary tube 51 of the bypass piping 50 to be 0.2 at the time of 0.1 and air conditioning operation for example, at the time of heating operation, it is only a signal from the 1st thermometric element 11 and the 1st pressure sensor 12, and calculates a circulation presentation. Actuation of the following, a control unit 21, and the comparison-operation means 22 is the same as that of an example 5.
[0063] Therefore, like an example 2, the operation in the presentation computing element 20 becomes easy, and the frozen air conditioner by this example can realize the same equipment as an example 5 by the easy equipment configuration, and becomes cheap.
[0064] Example 7. drawing 18 and drawing 19 show the 7th example of the frozen air conditioner concerning this invention, it is drawing 11 and drawing 18 and the element of the same number shows the same element. At the time of heating operation, it circulates through a refrigerant in the direction of the continuous-line arrow head in drawing 18 , and circulates through it in the direction of a broken-line arrow head at the time of air conditioning operation. The 2nd electric-type expansion valve 51 is formed in the bypass piping 50 as the 2nd expansion valve, and whenever [this valve-opening] is controlled by the control unit 21. Moreover, the heat exchange section 52 which performs piping (process line) which connects an outdoor heat exchanger 32 and the 1st electric-type expansion valve 3 in the middle of and heat exchange is formed, since the enthalpy in which the flowing refrigerant has the bypass piping 50 was transmitted to the refrigerant which flows a process line, the above-mentioned enthalpy was collected, and the energy loss is prevented. [the bypass piping 50] Furthermore, the 5th

thermometric element 16 is formed in the outlet section of this heat exchange section 52, and this detecting signal is sent to a control unit 21.

[0065] With the control device 21 in this example, since only the method of controlling the 2nd electric-type expansion valve 51 formed in the bypass piping 50 differs from an example 6, the method of controlling this 2nd electric-type expansion valve 51 is explained. The opening of the 2nd electric-type expansion valve 51 is controlled so that the temperature gradient of the entrance section of the heat exchange section 52 prepared in the bypass piping 50 serves as a predetermined value (for example, 10 degrees C). Namely, the signal of the 1st thermometric element 11 and the 5th thermometric element 16 formed in the bypass piping 51 is transmitted to a control unit 21. The difference of the temperature which this 1st thermometric element 11 and 5th thermometric element 16 detected in the control unit 21 is calculated. According to the difference of this temperature gradient and a predetermined value (for example, 10 degrees C), the adjusted value of the opening of the 2nd electric-type expansion valve 51 calculates by feedback control, such as PID control, and an electric-type expansion valve opening command is outputted to the 2nd electric-type expansion valve 51. By doing in this way, there is effectiveness which the refrigerant which goes to an accumulator 5 will always be in a steamy condition from the bypass piping 50, and energy is used effectively, and can also prevent the liquid return to a compressor 1.

[0066] In addition, a capillary tube etc. is sufficient although the above-mentioned example explained the case where an electric-type expansion valve was used as the 2nd expansion valve 51.

[0067] Example 8. drawing 20 and drawing 21 show the 8th example of the frozen air conditioner concerning this invention, it is drawing 18 and drawing 20 and the element of the same number shows the same element. At the time of heating operation, it circulates through a refrigerant in the direction of the continuous-line arrow head in drawing 20 , and circulates through it in the direction of a broken-line arrow head at the time of air conditioning operation. In this example, like an example 2 and an example 6, it is only the 1st thermometric element 11 and the 1st pressure sensor 12, and the signal inputted into the presentation computing element 20 assumes refrigerant dryness fraction X which flows into the 2nd electric-type expansion valve 51 of the bypass piping 50 to be 0.2 at the time of 0.1 and air conditioning operation for example, at the time of heating operation, it is only a signal from the 1st thermometric element 11 and the 1st pressure sensor 12, and calculates a circulation presentation. Actuation of the following, a control unit 21, and the comparison-operation means 22 is the same as that of an example 7.

[0068] In addition, a capillary tube etc. is sufficient although the above-mentioned example explained the case where an electric-type expansion valve was used as the 2nd expansion valve 51.

[0069] Moreover, although the above-mentioned example 5 thru/or the example 8 showed the frozen air conditioner which has an accumulator 5, it may not be. In this case, the bypass piping 50 serves as the configuration of connecting inhalation piping and the process line of a compressor through the 2nd expansion valve. Furthermore, although it consists of an above-mentioned example 5 thru/or an example 8 so that an alarm signal may be transmitted to an alarm 23 when the comparison-operation means 22 is connected and a circulation presentation separates from the predetermined range, it is not necessary to form these comparison-operations means 22 and an alarm 23. Moreover, the above-mentioned comparison-operation means 22 and an alarm 23 may be formed to an example 1 thru/or an example 4.

[0070]

[Effect of the Invention] In the frozen air conditioner which connects a compressor, a condenser, an expansion valve, and an evaporator using a non-azeotropy mixing refrigerant, and constitutes a refrigerating cycle according to claim 1 of this invention as mentioned above While forming the presentation computing element which calculates the temperature of the refrigerant of the evaporator inlet-port section, a pressure, and the refrigerant presentation that detects the coolant temperature of the condenser outlet section and circulates through the inside of a cycle Since the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element was formed, even

if the circulation presentation in a cycle changes, the always optimal operation is attained.
[0071] Moreover, according to claim 2 of this invention, it sets using a non-azeotropy mixing refrigerant to a compressor, a condenser, an expansion valve, and the frozen air conditioner that connects an evaporator and constitutes a refrigerating cycle. While forming the presentation computing element which calculates the refrigerant presentation which detects the temperature and the pressure of a refrigerant of the evaporator inlet-port section, and circulates through the inside of a cycle Since the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element was formed, there is the same effectiveness as the above-mentioned equipment by the easy equipment configuration.
[0072] Moreover, according to claim 3 of this invention, it sets using a non-azeotropy mixing refrigerant to a compressor, a condenser, an expansion valve, an evaporator, and the frozen air conditioner that connects an accumulator and constitutes a refrigerating cycle. While forming the presentation computing element which calculates the refrigerant presentation which detects the temperature and the pressure of a refrigerant between an accumulator and compressor inhalation piping in an accumulator, and circulates through the inside of a cycle Since the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element was formed, there is the same effectiveness as the above-mentioned equipment by the easy equipment configuration.
[0073] Moreover, according to claim 4 of this invention, it sets using a non-azeotropy mixing refrigerant to a compressor, a condenser, an expansion valve, an evaporator, and the frozen air conditioner that connects an accumulator and constitutes a refrigerating cycle. Since the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element was formed while forming the presentation computing element which calculates the refrigerant presentation which detects the oil level of an accumulator and circulates through the inside of a cycle, there is the same effectiveness as the above-mentioned equipment by the easy equipment configuration.
[0074] Moreover, according to claim 5 of this invention, it sets using a non-azeotropy mixing refrigerant to the frozen air conditioner which connects a compressor, a four way valve, the 1st heat exchanger, the 1st expansion valve, and the 2nd heat exchanger, and constitutes a refrigerating cycle. Connect the 1st heat exchanger, piping between the 1st expansion valve, and inhalation piping of a compressor for bypass piping through the 2nd expansion valve, and the coolant temperature of the temperature of the refrigerant of the outlet section of the 2nd expansion valve, a pressure, and the inlet-port section of the 2nd expansion valve is detected. Since the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element was formed while forming the presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle, even if the circulation presentation in a cycle changes, the always optimal operation is attained.
[0075] Moreover, according to claim 6 of this invention, it sets using a non-azeotropy mixing refrigerant to the frozen air conditioner which connects a compressor, a four way valve, the 1st heat exchanger, the 1st expansion valve, and the 2nd heat exchanger, and constitutes a refrigerating cycle. Connect the 1st heat exchanger, piping between the 1st expansion valve, and inhalation piping of a compressor for bypass piping through the 2nd expansion valve, and the temperature and the pressure of a refrigerant of the 2nd expansion valve are detected. [of the outlet section] Since the control unit which performs the operation control of a refrigerating cycle according to the circulation presentation detected by this presentation computing element was formed while forming the presentation computing element which calculates the refrigerant presentation which circulates through the inside of a cycle, there is the same effectiveness as the above-mentioned equipment by the easy equipment configuration.
[0076] Moreover, according to claim 7 of this invention, it sets using a non-azeotropy mixing refrigerant to the above-mentioned frozen air conditioner which connects a compressor, a four way valve, the 1st heat exchanger, the 1st expansion valve, and the 2nd heat exchanger, and constitutes a refrigerating cycle. While the always optimal operation is attained even if the

circulation presentation in a cycle changes since the heat exchange section which performs heat exchange for bypass piping for the 1st heat exchanger and piping between the 1st expansion valve was prepared, the frozen high air conditioner of energy efficiency is obtained.
[0077] Moreover, since according to claim 8 of this invention the alarm which operates with the alarm signal which the comparison-operation means which emits an alarm signal, and this comparison-operation means emit was formed when the circulation presentation detected with the presentation computing element separated from the predetermined range in each above-mentioned frozen air conditioner, offer of a frozen air conditioner with high safety and dependability is attained.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 1 of this invention.
[Drawing 2] It is the flow chart which shows actuation of the presentation computing element concerning the example 1 of this invention.
[Drawing 3] It is the explanatory view which explains actuation of the presentation computing element concerning the example 1 of this invention using a pressure-enthalpy line.
[Drawing 4] It is the explanatory view which explains actuation of the presentation computing element concerning the example 1 of this invention using the relation between the temperature of a non-azeotropy mixing refrigerant, and a circulation presentation.
[Drawing 5] It is the flow chart which shows actuation of the control device concerning the example 1 of this invention.
[Drawing 6] It is the block diagram showing the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 2 of this invention.
[Drawing 7] It is the block diagram showing the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 3 of this invention.
[Drawing 8] It is the explanatory view which explains actuation of the presentation computing element concerning the example 3 of this invention using the relation between the temperature of a non-azeotropy mixing refrigerant, and a circulation presentation.
[Drawing 9] It is the block diagram showing the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 4 of this invention.
[Drawing 10] It is the explanatory view which explains actuation of the presentation computing element concerning the example 4 of this invention using the relation between the refrigerant oil-level height in an accumulator, and a circulation presentation.
[Drawing 11] It is the block diagram showing the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 5 of this invention.
[Drawing 12] It is the control-block Fig. of the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 5 of this invention.

[Drawing 13] It is the explanatory view which explains actuation of the control unit concerning the example 5 of this invention using the relation between the condensation pressure of a non-azeotropy mixing refrigerant, and a circulation presentation.
[Drawing 14] It is the explanatory view which explains actuation of the control unit concerning the example 5 of this invention using the relation between the evaporation pressure of a non-azeotropy mixing refrigerant, and a circulation presentation.
[Drawing 15] It is the explanatory view which explains actuation of the control unit concerning the example 5 of this invention using the relation between the saturated liquid temperature of a non-azeotropy mixing refrigerant, a pressure, and a circulation presentation.
[Drawing 16] It is the block diagram showing the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 6 of this invention.
[Drawing 17] It is the control-block Fig. of the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 6 of this invention.
[Drawing 18] It is the block diagram showing the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 7 of this invention.
[Drawing 19] It is the control-block Fig. of the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 7 of this invention.
[Drawing 20] It is the block diagram showing the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 8 of this invention.
[Drawing 21] It is the control-block Fig. of the frozen air conditioner using the non-azeotropy mixing refrigerant by the example 8 of this invention.
[Drawing 22] It is the block diagram showing the frozen air conditioner using the conventional non-azeotropy mixing refrigerant.
[Description of Notations]
1 Compressor 2 Condenser
3 Electric-Type Expansion Valve 4 Evaporator
5 Accumulator 11 Thermometric Element
12 Pressure Sensor 13 Thermometric Element
14 Pressure Sensor 15 Oil-Level Detector
16 Thermometric Element 20 Presentation Computing Element
21 Control Unit 22 Comparison-Operation Machine
23 Alarm 31 Four Way Valve
32 Outdoor Heat Exchanger 41 Indoor Heat Exchanger
42 Thermometric Element 43 Thermometric Element
50 Bypass Piping 51 2nd Expansion Valve
52 Heat Exchange Section

[Translation done.]

DRAWINGS

[Drawing 1]

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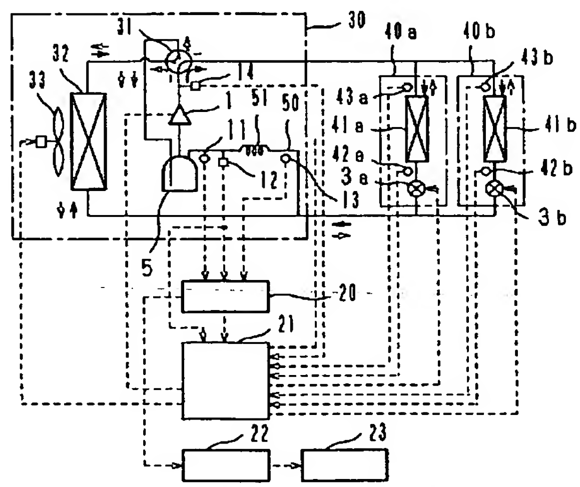
(54)【発明の名称】　非共沸混合冷媒を用いた冷凍空調装置

(57)【要約】
【目的】　冷凍サイクル内を循環する非共沸混合冷媒の冷媒組成が変化しても常に最適な運転が可能な冷凍空調装置を得る。
【構成】　圧縮機１、四方弁３１、第１熱交換器３２、第１膨張弁３ａ、３ｂ、及び第２熱交換器４１ａ、４１ｂ、アキュムレータ５を連結して冷凍サイクルを構成し、第１熱交換器３２と第１膨張弁３ａ、３ｂの間の配管と、アキュムレータ５とを第２膨張弁５１を介してバイパス配管５０で接続し、第２膨張弁５１の出口部の冷媒の温度と圧力、及び第２膨張弁５１の入口部の冷媒温度を検出して、サイクル内を循環する冷媒組成を組成演算器２０で演算すると共に、この組成演算器２０により検出された循環組成に応じて冷凍サイクルの運転制御を制御装置２１で行う。



3ａ, 3ｂ：第１膨張弁　22：比較演算器　23：警報装置　31：四方弁　32：室外熱交換器　41ａ, 41ｂ：室内熱交換器　50：バイパス配管　51：第２膨張弁

【特許請求の範囲】

【請求項1】　冷媒として非共沸混合冷媒を用い、圧縮機、凝縮器、膨張弁、及び蒸発器を連結して冷凍サイクルを構成するものにおいて、蒸発器入口部の冷媒温度を検出する第1温度検出器、上記蒸発器入口部の冷媒圧力を検出する圧力検出器、凝縮器出口部の冷媒温度を検出する第2温度検出器、第1温度検出器と上記圧力検出器と第2温度検出器で検出した信号から、サイクル内を循環する冷媒組成を演算する組成演算器、及びこの組成演算器により検出された冷媒組成に応じて上記冷凍サイクルの運転制御を行う制御装置を備えたことを特徴とする非共沸混合冷媒を用いた冷凍空調装置。

【請求項2】　冷媒として非共沸混合冷媒を用い、圧縮機、凝縮器、膨張弁、及び蒸発器を連結して冷凍サイクルを構成するものにおいて、蒸発器入口部の冷媒温度を検出する温度検出器、上記蒸発器入口部の冷媒圧力を検出する圧力検出器、上記温度検出器と上記圧力検出器で検出した信号から、サイクル内を循環する冷媒組成を演算する組成演算器、及びこの組成演算器により検出された冷媒組成に応じて上記冷凍サイクルの運転制御を行う制御装置を備えたことを特徴とする非共沸混合冷媒を用いた冷凍空調装置。

【請求項3】　冷媒として非共沸混合冷媒を用い、圧縮機、凝縮器、膨張弁、蒸発器、及びアキュムレータを連結して冷凍サイクルを構成するものにおいて、アキュムレータ内、または上記アキュムレータと圧縮機吸入配管との間の冷媒温度を検出する温度検出器、上記アキュムレータ内、または上記アキュムレータと圧縮機吸入配管との間の冷媒圧力を検出する圧力検出器、上記温度検出器と上記圧力検出器で検出した信号から、サイクル内を循環する冷媒組成を演算する組成演算器、及びこの組成演算器により検出された冷媒組成に応じて上記冷凍サイクルの運転制御を行う制御装置を備えたことを特徴とする非共沸混合冷媒を用いた冷凍空調装置。

【請求項4】　冷媒として非共沸混合冷媒を用い、圧縮機、凝縮器、膨張弁、蒸発器、及びアキュムレータを連結して冷凍サイクルを構成するものにおいて、上記アキュムレータの液面を検知する液面検知手段、この液面検出手段で検出した信号から、サイクル内を循環する冷媒組成を演算する組成演算器、及びこの組成演算器により検出された冷媒組成に応じて上記冷凍サイクルの運転制御を行う制御装置を備えたことを特徴とする非共沸混合冷媒を用いた冷凍空調装置。

【請求項5】　冷媒として非共沸混合冷媒を用い、圧縮機、四方弁、第1熱交換器、第1膨張弁、及び第2熱交換器を連結して冷凍サイクルを構成するものにおいて、第1熱交換器と第1膨張弁の間の配管と、上記圧縮機の吸入配管とを第2膨張弁を介して接続するバイパス配管、第2膨張弁の出口部の冷媒温度を検出する第1温度検出器、第2膨張弁の出口部の冷媒圧力を検出する圧力検出器、第2膨張弁の入口部の冷媒温度を検出する第2温度検出器、第1温度検出器と上記圧力検出器と第2温度検出器で検出した信号から、サイクル内を循環する冷媒組成を演算する組成演算器、及びこの組成演算器により検出された冷媒組成に応じて上記冷凍サイクルの運転制御を行う制御装置を備えたことを特徴とする非共沸混合冷媒を用いた冷凍空調装置。

【請求項6】　冷媒として非共沸混合冷媒を用い、圧縮機、四方弁、第1熱交換器、第1膨張弁、及び第2熱交換器を連結して冷凍サイクルを構成するものにおいて、第1熱交換器と第1膨張弁の間の配管と、上記圧縮機の吸入配管とを第2膨張弁を介して接続するバイパス配管、第2膨張弁の出口部の冷媒温度を検出する温度検出器、第2膨張弁の出口部の冷媒圧力を検出する圧力検出器、上記温度検出器と上記圧力検出器で検出した信号から、サイクル内を循環する冷媒組成を演算する組成演算器、及びこの組成演算器により検出された冷媒組成に応じて上記冷凍サイクルの運転制御を行う制御装置を備えたことを特徴とする非共沸混合冷媒を用いた冷凍空調装置。

【請求項7】　バイパス配管に、第1熱交換器と第1膨張弁の間の配管とで熱交換を行う熱交換部を設けたことを特徴とする請求項5または6記載の非共沸混合冷媒を用いた冷凍空調装置。

【請求項8】　組成演算器により検出された冷媒組成が所定範囲から外れた場合に警告信号を発する比較演算手段、及びこの比較演算手段が発する警報信号によって動作する警報手段を設けたことを特徴とする請求項1ないし7のいずれかに記載の非共沸混合冷媒を用いた冷凍空調装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は非共沸混合冷媒を用いた冷凍空調装置に関し、特に冷媒循環組成が初期充填組成と異なった場合でも、信頼性が高く、かつ効率良く運転を行う冷凍空調装置の構成に関するものである。

【0002】

【従来の技術】図22は特開昭61－6546号公報に示された従来の非共沸混合冷媒を用いた冷凍空調装置の構成を示すものである。図において、1は圧縮機、2は凝縮器、3は膨張弁、4は蒸発器、5はアキュムレータであり、これらは配管により直列に接続されて冷凍空調装置を構成し、高沸点成分と低沸点成分とからなる非共沸混合冷媒を用いている。

【0003】上記のように構成された冷凍空調装置において、圧縮機1で圧縮された高温高圧の冷媒ガスは凝縮器2で凝縮液化し、膨張弁3で減圧されて低圧の気液二相冷媒となって蒸発器4に流入する。この冷媒は、蒸発器4で蒸発し、アキュムレータ5を経て圧縮機1に戻り、再び圧縮されて凝縮器2へ送り込まれる。またアキ

ュムレータ５は、冷凍空調装置の運転条件や負荷条件によって発生した余剰な冷媒を溜めることにより、圧縮機１への液戻りを防止している。

【０００４】このような冷凍空調装置では、冷媒として目的に合わせた非共沸混合冷媒を使用することにより、単一冷媒では得られなかったより低い蒸発温度、あるいはより高い凝縮温度が得られたり、あるいはサイクル効率がより向上するなどの利点が得られることは従来から知られている。また、従来から広く用いられているＲ１２やＲ２２などの冷媒は、オゾン層破壊の原因となるため、これらの代替冷媒として非共沸混合冷媒が提案されている。

【０００５】

【発明が解決しようとする課題】従来の非共沸混合冷媒を用いた冷凍空調装置は以上のように構成されているので、冷凍空調装置の運転条件や負荷条件が一定であれば、冷凍サイクル内を循環する冷媒組成は一定であり、上述のような効率の良い冷凍サイクルを構成する。ところが運転条件や負荷条件が変化し、特にアキュムレータ内に貯溜される冷媒量が変化すると、冷凍サイクル内を循環する冷媒組成が変化し、この循環冷媒組成に応じた冷凍サイクルの制御、すなわち圧縮機の回転数制御や膨張弁の開度制御等による冷媒流量の調整が必要となる。しかし、従来の冷凍空調装置では、この循環冷媒組成を検知する手段を設けていないため、循環冷媒組成に応じた最適な運転が維持できないという問題点があった。また冷凍サイクルの使用中の冷媒漏れや、あるいは冷媒充填時の誤動作で循環冷媒組成が変化した場合にも、この循環冷媒組成の異常を検知できず、安全性、及び信頼性の高い冷凍空調装置が得られないという問題点があった。

【０００６】本発明は上記のような問題点を解消するためになされたもので、冷凍サイクル内を循環する冷媒組成が変化しても常に最適な冷凍サイクルの運転を可能にした冷凍空調装置を得ることを目的としている。

【０００７】

【課題を解決するための手段】本発明の請求項１に係る非共沸混合冷媒を用いた冷凍空調装置は、圧縮機、凝縮器、膨張弁、及び蒸発器を連結して冷凍サイクルを構成するものにおいて、蒸発器入口部の冷媒の温度と圧力、及び凝縮器出口部の冷媒温度を検出してサイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたものである。

【０００８】本発明の請求項２に係る非共沸混合冷媒を用いた冷凍空調装置は、圧縮機、凝縮器、膨張弁、及び蒸発器を連結して冷凍サイクルを構成するものにおいて、蒸発器入口部の冷媒の温度と圧力を検出してサイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたものである。

【０００９】本発明の請求項３に係る非共沸混合冷媒を用いた冷凍空調装置は、圧縮機、凝縮器、膨張弁、蒸発器、及びアキュムレータを連結して冷凍サイクルを構成するものにおいて、アキュムレータ内、あるいはアキュムレータと圧縮機吸入配管との間の冷媒の温度と圧力を検出してサイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて圧縮機や膨張弁の制御を行う制御装置を設けたものである。

【００１０】本発明の請求項４に係る非共沸混合冷媒を用いた冷凍空調装置は、圧縮機、凝縮器、膨張弁、蒸発器、及びアキュムレータを連結して冷凍サイクルを構成するものにおいて、アキュムレータの液面を検出してサイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたものである。

【００１１】本発明の請求項５に係る非共沸混合冷媒を用いた冷凍空調装置は、圧縮機、四方弁、第１熱交換器、第１膨張弁、及び第２熱交換器を連結して冷凍サイクルを構成するものにおいて、第１熱交換器と第１膨張弁の間の配管と、圧縮機の吸入配管とを第２膨張弁を介してバイパス配管で接続し、第２膨張弁の出口部の冷媒の温度と圧力、及び第２膨張弁の入口部の冷媒温度を検出して、サイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたものである。

【００１２】本発明の請求項６に係る非共沸混合冷媒を用いた冷凍空調装置は、圧縮機、四方弁、第１熱交換器、第１膨張弁、及び第２熱交換器を連結して冷凍サイクルを構成するものにおいて、第１熱交換器と第１膨張弁の間の配管と、圧縮機の吸入配管とを第２膨張弁を介してバイパス配管で接続し、第２膨張弁の出口部の冷媒の温度と圧力を検出して、サイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたものである。

【００１３】本発明の請求項７に係る非共沸混合冷媒を用いた冷凍空調装置は、請求項５または６の冷凍空調装置におけるバイパス配管に、第１熱交換器と第１膨張弁の間の配管とで熱交換を行う熱交換部を設けたものである。

【００１４】本発明の請求項８に係る非共沸混合冷媒を用いた冷凍空調装置は、上記各冷凍空調装置に対して、組成演算器で検出された循環組成が所定範囲から外れた場合に警告信号を発する比較演算手段と、この比較演算

手段が発する警報信号によって動作する警報手段を設けたものである。

【００１５】

【作用】本発明の請求項１においては、圧縮機、凝縮器、膨張弁、及び蒸発器を連結した冷凍サイクル内を循環する冷媒組成を、蒸発器入口部の冷媒の温度と圧力、及び凝縮器出口部の冷媒温度を検出して、検出値を組成演算器に入力し、演算する。組成演算器が検出した冷媒循環組成は制御装置に入力され、冷媒循環組成に応じた圧縮機や膨張弁などの制御値が決定されるため、冷凍空調装置の運転条件や負荷条件の変化により循環組成が変化した場合や、あるいは冷凍空調装置使用中の冷媒漏れや、冷媒充填時の誤動作で循環組成が変化した場合でも冷凍空調装置の最適運転を可能にすることができる。

【００１６】本発明の請求項２においては、上記冷凍サイクルにおける蒸発器入口部の冷媒の温度と圧力のみを組成演算器に入力し、組成演算器では蒸発器へ流入する冷媒の乾き度が所定の値と仮定して冷媒組成を演算する。従って、簡単な装置構成で、上記装置と同様のものが実現する。

【００１７】本発明の請求項３においては、圧縮機、凝縮器、膨張弁、蒸発器、及びアキュムレータを連結した冷凍サイクルにおいて、アキュムレータ内、または上記アキュムレータと圧縮機吸入配管との間の冷媒温度と圧力を検出して、検出値を組成演算器に入力し、組成演算器ではアキュムレータへ流入する冷媒の乾き度が所定の値と仮定して冷媒組成を演算する。従って、上記装置と同様、簡単な装置構成で、循環組成が変化した場合でも冷凍空調装置の最適運転を可能にすることができる。

【００１８】本発明の請求項４においては、アキュムレータの液面を検知し、検知信号を組成演算器に入力する、組成演算器では予め調べておいた液面の高さと循環組成の関係から、冷媒組成を演算する。従って、上記装置と同様、簡単な装置構成で、循環組成が変化した場合でも冷凍空調装置の最適運転を可能にすることができる。

【００１９】本発明の請求項５、及び６においては、圧縮機、四方弁、第１熱交換器、第１膨張弁、及び第２熱交換器を連結した冷凍サイクルにおいて、第１熱交換器と第１膨張弁の間の配管と、上記圧縮機の吸入配管とを第２膨張弁を介して接続するバイパス配管を設け、ここに温度検出器と圧力検出器を設けて冷媒組成を演算する。この様な構成では、第２膨張弁の下流側が常に低圧の二相状態になるので、冷房、暖房にかかわらず、同一の検出器で検出された温度、及び圧力から冷媒組成がわかる。

【００２０】本発明の請求項７においては、バイパス配管に熱交換部を設け、バイパス配管を流れる冷媒の持つエンタルピーを主配管を流れる冷媒へ伝達し、エネルギーロスを防ぐ。

【００２１】本発明の請求項８においては、組成演算器が検出した冷媒循環組成が、予め定めた所定範囲から外れた場合には、これを比較演算手段によって判断し、警報手段を作動させるため、非共沸混合冷媒の循環組成が使用中に冷媒漏れによって変化したり、冷媒充填時の誤動作で循環組成が変化したことを確実に検知でき、安全性や信頼性の高い冷凍空調装置の提供が可能となる。

【００２２】

【実施例】

実施例１．以下、本発明の実施例を図について説明する。図１は本発明に係わる冷凍空調装置の第１の実施例を示すもので、１は圧縮機、２は凝縮器、３は電気式膨張弁、４は蒸発器、５はアキュムレータであり、これらを配管により直列に接続することにより冷凍サイクルを構成しており、電気式膨張弁３の開度は制御装置２１の出力信号により制御される。この冷凍サイクルには、例えば高沸点成分Ｒ１３４ａと低沸点成分Ｒ３２からなる非共沸混合冷媒が充填されている。

【００２３】蒸発器４の入口部には、その冷媒温度T_1を検出する第１温度検出器１１と冷媒圧力P_1を検出する第１圧力検出器１２がそれぞれ設けられており、また凝縮器２の出口部には、その冷媒温度T_2を検出する第２温度検出器１３が設けられており、これら検出器１１、１２、１３の検出信号は組成演算器２０に入力される。また、圧縮機１の吐出配管にはその冷媒圧力を検出する第２圧力検出器１４が設けられており、この検出器１４の検出信号は、検出器１３の検出信号とともに制御装置２１に入力される。

【００２４】組成演算器２０は、検出器１１、１２、１３が検出する温度T_1、圧力P_1、温度T_2に基づいて非共沸混合冷媒の循環組成αを演算する機能を有しており、この循環組成αの演算値は制御装置２１に入力される。また制御装置２１は、循環組成αと検出器１４が検出する圧力P_2から凝縮圧力における飽和液温度T_Lを演算する機能と、この飽和液温度T_Lと検出器１３が検出する温度T_2から凝縮器２の出口部における過冷却度を演算する機能と、この過冷却度が所定の値となるように電気式膨張弁３の開度を制御する機能を有している。

【００２５】次に、上記のように構成された本実施例の動作について説明する。圧縮機１で圧縮された高温高圧の冷媒ガスは凝縮器２で凝縮液化し、膨張弁３で減圧され、低圧の気液二相冷媒となって蒸発器４に流入する。この冷媒は、蒸発器４で蒸発し、アキュムレータ５を経て圧縮機１に戻り、再び圧縮されて凝縮器２へ送り込まれる。冷凍空調装置の運転条件や負荷条件によって発生した余剰な冷媒は、アキュムレータ５内に溜る。

【００２６】次に、組成演算器２０の動作を図２に示すフローチャート、及び図３に示す冷凍サイクルの圧力－エンタルピー線図、図４の非共沸混合冷媒の気液平衡線図に基づいて説明する。なお、図３において、実線Ａは

循環組成αに対する飽和液曲線、実線Bは循環組成αに対する飽和蒸気曲線、実線Cはサイクル動作線、一点鎖線は等温線である。また、図4において、横軸は低沸点成分の重量分率、縦軸は温度、点線は蒸発器4の入口部の圧力がP_1の時の飽和蒸気温度（X＝1）、一点鎖線は飽和液温度（X＝0）、実線は乾き度Xにおける温度（0＜X＜1）である。組成演算器20の動作が開始されると、まずステップS1では、検出器11、12、13で検出された蒸発器4の入口部の冷媒温度T_1と圧力P_1、及び凝縮器2の出口部の温度T_2を組成演算器20に取り込む。次にステップS2では、冷凍サイクル内の循環組成αを仮定し、ステップS3では、この仮定の下で、蒸発器4へ流入する冷媒の乾き度Xを計算する。すなわち図3に示すように仮定した循環組成αの下では、凝縮器2の出口部の温度T_2からエンタルピーHが求まり、蒸発器4の入口部の圧力P_1よりH_Lが得られ、蒸発器4の入口部の乾き度Xが近似的に次式により一義的に定まる。

【0027】

【数1】

$$X=\frac{H-H_L}{H_V-H_L}$$

【0028】ここでH_Vは飽和蒸気曲線とサイクル動作線が交わる点のエンタルピーである。実際には乾き度Xと温度T_2、及び圧力P_1との関係を予め組成演算器20内に記憶しておき、温度T_2、圧力P_1の値を用いて、乾き度Xを算出する。さらにステップS4では、この蒸発器4の入口部の乾き度Xと蒸発器4の入口部の冷媒温度T_1、及び圧力P_1より循環組成α^*を計算する。すなわち乾き度がXである気液二相状態の非共沸混合冷媒の温度と圧力は、図4に示すように冷凍サイクル内を流れる循環組成によって定まる。したがって図4中実線で示した特性を用いることにより、循環組成α^*を計算することができる。ステップS5では、この循環組成α^*と最初に仮定した循環組成αを比較し、両者が一致していれば、循環組成はαとして求まる。両者が一致していなければ、ステップS2に戻り、再び循環組成αを仮定し直し、両者が一致するまで計算を続行する。

【0029】次に、制御装置21の動作を図5に示すフローチャートを用いて説明する。制御装置21の動作が開始されると、まずステップS1では、凝縮器2の出口部の温度T_2と凝縮圧力P_2を検出する。次にステップS2では、組成演算器20より循環組成αを取り込み、ステップS3では、凝縮圧力P_2と循環組成αから、圧力P_2における飽和液温度T_Lを計算する。この飽和液温度T_Lは、循環組成αが定まっているため、圧力P_2より一義的に定まる（図3参照）。さらにステップS4では、T_2とT_Lから凝縮器2の出口部の冷媒過冷却度SCを計算する（SC＝T_L－T_2）。ステップS5では、この過冷却度SCが所定の値、例えば5℃と一致しているか否かを判定し、所定の値と一致していると判断されたときには、終了ステップへ移行する。また所定のの値と一致していないと判断された場合には、ステップS6へ移行して電気式膨張弁3の開度変更処理を実行する。

【0030】上記の動作を繰り返すことにより、冷凍空調装置の運転条件や負荷条件の変化により冷凍サイクル内の循環組成が変化した場合や、あるいは冷凍空調装置使用中の冷媒漏れや、冷媒充填時の誤動作で循環組成が変化した場合でも、凝縮器2の出口部の過冷却度は適正値に保たれ、常に最適な運転が可能となる。

【0031】なお、本実施例としては、混合冷媒として二成分系を対象として説明したが、三成分系など多成分系の場合においても同様の効果を得ることができる。

【0032】また本実施例の制御装置21では、サイクル内の循環組成が変化しても、凝縮器2の出口部の過冷却度を一定に保つように電気式膨張弁3の開度を制御するものについて説明したが、蒸発器4の出口部の温度を検出して、循環組成αと蒸発圧力P_1から圧力P_1における飽和蒸気温度T_vを計算し（図3参照）、蒸発器4の出口部の過熱度が一定となるように制御するものであっても、上記と同様、冷凍空調装置の最適運転を可能にすることができる。

【0033】さらに本実施例では、制御装置21は、サイクル内の循環組成が変化しても電気式膨張弁3の開度を最適に制御するものについて説明したが、圧縮機1の回転数を循環組成に応じて制御するものであっても、同様の効果を得ることができる。

【0034】実施例2．図6は本発明に係わる冷凍空調装置の第2の実施例を示すもので、蒸発器4の入口部には、その冷媒温度T_1を検出する第1温度検出器11と第1冷媒圧力P_1を検出する第1圧力検出器12がそれぞれ設けられており、これら検出器11、12検出信号は組成演算器20に入力される。また凝縮器2の出口部には、その冷媒温度T_2を検出する第2温度検出器13が設けられており、また圧縮機1の吐出配管にはその冷媒圧力を検出する第2圧力検出器14が設けられており、これら検出器13、14の検出信号は、制御装置21に入力される。

【0035】組成演算器20は、検出器11、12、が検出する温度T_1、及び圧力P_1に基づいて非共沸混合冷媒の循環組成αを演算する機能を有しており、この循環組成αの演算値は制御装置21に入力される。また制御装置21は、循環組成αと検出器14が検出する圧力P_2から凝縮圧力における飽和液温度T_Lを演算する機能と、この飽和液温度T_Lと検出器13が検出する温度T_2から凝縮器2の出口部の過冷却度を演算する機能と、この過冷却度が所定の値となるように電気式膨張弁3の開度を制御する機能を有している。

【００３６】次に、本実施例の組成演算器２０の動作を説明する。組成演算器２０では、まず蒸発器４の入口部の温度T_1と圧力P_1を取り込む。蒸発器４へ流入する冷媒は、通常乾き度が０．１から０．３程度の気液二状態となっており、この乾き度を例えば０．２と仮定することにより、温度T_1と圧力P_1の情報のみで、循環組成αを推定することができる。すなわち、図４中に実線で示した特性を用いることにより、温度T_1と圧力P_1から循環組成αを計算することができる。

【００３７】なお、制御装置２１の動作は、実施例１と同様であるため、説明は省略するが、本実施例では蒸発器４の入口部の温度と圧力のみにより、冷凍サイクル内の循環組成を検出することができ、循環組成が変化しても凝縮器２の出口部の過冷却度は適正値に保たれ、常に最適な運転が可能となる。

【００３８】なお、乾き度Ｘの設定値は上記実施例では０．１から０．３程度としたが、上記値に限定しない。

【００３９】このように構成することにより、組成演算器２０での演算が簡単になり、簡単な装置構成で上記と同様の装置が実現でき、安価となる。

【００４０】実施例３．図７は本発明に係わる冷凍空調装置の第３の実施例を示すものであり、アキュムレータ５内には、その冷媒温度T_1を検出する第１温度検出器１１と冷媒圧力P_1を検出する圧力検出器１２がそれぞれ設けられており、これら検出器１１、１２の検出信号は組成演算器２０に入力される。組成演算器２０は、検出器１１、１２、が検出するアキュムレータ５内の温度T_1、及び圧力P_1に基づいて非共沸混合冷媒の循環組成αを演算する機能を有しており、以下、この組成演算器２０の動作について説明する。

【００４１】演算制御器２０では、まず検出器１１、１２で検出されたアキュムレータ５内の冷媒温度T_1と圧力P_1を取り込む。アキュムレータ５へ流入する冷媒は、通常乾き度が０．８～１．０程度の気液二相状態となっているが、近似的に乾き度を例えば０．９と見なすことができる。この状態の冷媒の温度と圧力は、図８に示すように冷凍サイクル内を流れる非共沸混合冷媒の循環組成によって定まる。したがって図８中実線で示した特性を用いることによりアキュムレータ５内の温度T_1、及び圧力P_1のみで、循環組成αを演算することができる。

【００４２】なお、制御装置２１の動作は、実施例１と同様であるため、説明は省略するが、本実施例ではアキュムレータ５内の温度と圧力のみにより、冷凍サイクル内の循環組成を検出することができ、実施例２と同様、組成演算器２０での演算が簡単になり、簡単な装置構成で、実施例１と同様の装置が、安価に得られる。

【００４３】なお、本実施例ではアキュムレータ５内の温度と圧力を測定するものを示したが、アキュムレータ５と圧縮機１の吸入配管との間に第１温度検出器１１と圧力検出器１２を設けてもよい。また、乾き度Ｘの設定値は上記実施例では０．８から１．０程度としたが、上記値に限定しない。

【００４４】実施例４．図９は本発明に係わる冷凍空調装置の第４の実施例を示すもので、アキュムレータ５には、その内部の冷媒液面を検出する液面検出器１５が設けられており、さらにこの液面検出器１５の信号は、組成演算器２０に入力される。この液面検出器１５としては、例えば超音波式液面計や静電容量式液面計など公知の液面計が用いられる。組成演算器２０は、検出器１５が検出するアキュムレータ５内の冷媒液面高さｈに基づいて、非共沸混合冷媒の循環組成αを演算する機能を有しており、以下、この組成演算器２０の動作について説明する。

【００４５】組成演算器２０の動作が開始されると、まず液面検出器１５で検出されたアキュムレータ５内の冷媒液面高さｈを取り込む。一般に、非共沸混合冷媒を用いた冷凍サイクルのアキュムレータ内の冷媒は、高沸点成分に富んだ液相と、低沸点成分に富んだ気相に分離され、高沸点成分に富んだ液相はアキュムレータ内に貯溜される。このためアキュムレータ内に液冷媒が存在すると、冷凍サイクル内を循環する冷媒組成は低沸点成分が多くなる（循環組成が増加する）傾向を示す。図１０はこのアキュムレータ内の冷媒液面高さｈと循環組成αの関係を示したもので、アキュムレータ内の冷媒液面高さが増加する、すなわちアキュムレータ内の液冷媒量が増加する程、循環組成は増加する。したがって、この図１０に示した関係を予め実験などによって調べておけば、液面検出器１５で検出されたアキュムレータ５内の冷媒液面高さｈから循環組成αを演算することができる。

【００４６】なお、制御装置２１の動作は、実施例１と同様であるため、説明は省略するが、本実施例ではアキュムレータ５内の冷媒液面高さのみにより、冷凍サイクル内の循環組成を検出することができ、装置構成が簡単で、かつ循環組成が変化しても凝縮器２の出口部の過冷却度は適正値に保たれ、常に最適な運転が可能となる。

【００４７】なお、上記実施例では、液面検知手段１５として超音波式や静電容量式などの液面計を用いた場合について説明したが、冷凍サイクルの運転条件や負荷条件に基づいてサイクル内の余剰な冷媒量を演算し、アキュムレータ５内の液面高さを検出しても同様の効果を発揮する。例えば、冷房運転時は余剰冷媒は発生せず、暖房運転時にはある量の余剰冷媒が発生することを、予め実験などによって調べておき、予め計測されたこの運転条件と余剰冷媒量の関係から、アキュムレータ５内の液面高さを演算で検出しても良い。またこの際、冷暖房運転時の室内空気温度や室外空気温度などの情報を付加して、アキュムレータ内の液面検出精度を向上させても良い。

【００４８】実施例５．図１１は本発明に係わる冷凍空

調装置の第５の実施例を示すものであり、１台の室外機に２台の室内機を接続してなる冷凍空調装置を示している。図１１において、３０は室外機で、圧縮機１、及び四方弁３１、室外熱交換器（第１熱交換器）３２、室外送風機３３、アキュムレータ５で構成されており、圧縮機１の吐出側の配管には第２圧力検出器１４が設けられている。４０ａ、４０ｂ（以下、総称する時は４０）は各々室内機で、室内熱交換器（第２熱交換器）４１ａ、または４１ｂ（以下、総称する時は４１）と、第１膨張弁である電気式膨張弁３ａ、または３ｂ（以下、総称する時は３）で構成されており、室内熱交換機４１の出入口部には、各々第３温度検出器４２ａ、４２ｂ（以下、総称する時は４２）、及び第４温度検出器４３ａ、４３ｂ（以下、総称する時は４３）が設けられている。また室外熱交換器３２と室内機４０内の電気式膨張弁３を接続する配管の途中には、この配管とアキュムレータ５を接続するバイパス配管５０が設けられており、このバイパス配管５０の途中には第２膨張弁である毛細管５１が設けられている。また、バイパス配管５０には、毛細管５１の出口部に第１温度検出器１１と第１圧力検出器１２が設けられており、また毛細管５１の入口部には第２温度検出器１３が設けられている。なお、室内送風機は省略している。

【００４９】２０は組成演算器であり、バイパス配管５０に設けられた第１温度検出器１１、第１圧力検出器１２、第２温度検出器１３の信号が入力され、サイクル内を循環する冷媒組成を演算する。２１は制御装置であり、組成演算器２０からの循環組成信号、及び第１圧力検出器１２、第２圧力検出器１４、室内機４０内の第３温度検出器４２、第４温度検出器４３からの信号が入力される。制御装置２１では、これらの入力信号を下に、循環組成に応じた圧縮機１の回転数と室外送風機３３の回転数、室内機の電気式膨張弁３の開度を演算し、その指令を圧縮機１、室外送風機３３、電気式膨張弁３にそれぞれ送信する。圧縮機１、及び室外送風機３３、電気式膨張弁３では、制御装置２１より送られた指令値を受けて、その回転数や弁開度が駆動される。また、２２は比較演算手段であり、組成演算器２０より循環組成信号が入力され、循環組成が予め定めた所定範囲内に入っているか否かを比較演算する。この比較演算手段２２には、警報装置２３が接続されており、循環組成が所定範囲から外れた場合には、警告信号を警報装置２３に送信する。

【００５０】次に、上記のように構成された本実施例の動作について、図１１、及び図１２に示す制御ブロック図を用いて説明する。組成演算器２０は、バイパス配管５０に設けた第１温度検出器１１、第１圧力検出器１２、第２温度検出器１３からの信号を取り込み、図３、及び図４に示した関係を用いて、毛細管５１の入口部の冷媒乾き度Ｘを計算し、サイクル内の循環組成αを演算する。制御装置２１では、この循環組成αに応じた最適な圧縮機１の回転数指令と室外送風機３３の回転数指令、電気式膨張弁３の開度指令を演算する。

【００５１】まず暖房運転について説明する。暖房運転時には、冷媒は図１１中の実線矢印の方向に循環し、室内熱交換器４１が凝縮器となって暖房が行われる。圧縮機１の回転数は、凝縮圧力が目標値に一致するように制御され、この凝縮圧力目標値は、例えば凝縮温度Ｔｃが５０℃となる圧力として求まる。非共沸混合冷媒の凝縮温度を、飽和蒸気温度と飽和液温度の平均値と定義すると、凝縮温度Ｔｃが５０℃となる凝縮圧力目標値Ｐｃは、図１３に示すように、循環組成αにより一義的に定まる。従って制御装置２１では、予め図１３の関係式を記憶させておき、組成演算器２０から送信される循環組成信号を用いて、凝縮圧力目標値が演算される。さらに制御装置２１では、第２圧力検出器１４が検出する圧力と凝縮圧力目標値との差に応じて、ＰＩＤ制御等のフィードバック制御により圧縮機１の回転数の修正値が演算され、圧縮機回転数指令が圧縮機１に出力される。

【００５２】室外送風機３３の回転数は、蒸発圧力が目標値に一致するように制御され、この蒸発圧力目標値は、例えば蒸発温度Ｔｅが０℃となる圧力として求まる。非共沸混合冷媒の蒸発温度を、飽和蒸気温度と飽和液温度の平均値と定義すると、蒸発温度Ｔｅが０℃となる蒸発圧力目標値Ｐｅは、図１４に示すように、循環組成αにより一義的に定まる。従って制御装置２１では、予め図１４の関係式を記憶させておき、組成演算器２０から送信される循環組成信号を用いて、蒸発圧力目標値が演算される。さらに制御装置２１では、第１圧力検出器１２が検出する圧力と蒸発圧力目標値との差に応じて、ＰＩＤ制御等のフィードバック制御により室外送風機３３の回転数の修正値が演算され、室外送風機回転数指令が室外送風機３３に出力される。

【００５３】電気式膨張弁３の開度は、室内熱交換器４１の出口部の過冷却度が所定の値、例えば５℃となるように制御される。この過冷却度は、室内熱交換器４１内の圧力における飽和液温度と室内熱交換器４１の出口部の温度との差として求めることができ、飽和液温度は図１５に示すように圧力と循環組成の関数として求めることができる。従って制御装置２１では、予め図１５の関係式を記憶させておき、組成演算器２０から送信される循環組成信号と第２圧力検出器１４から送信される圧力信号、及び第３温度検出器４２から送信される温度信号を用いて、飽和液温度、及び室内熱交換器４１の出口部過冷却度が演算される。さらに制御装置２１では、この出口部の過冷却度と所定値（５℃）との差に応じて、ＰＩＤ制御等のフィードバック制御により電気式膨張弁３の開度の修正値が演算され、電気式膨張弁開度指令が電気式膨張弁３に出力される。

【００５４】一方、冷房運転時には、冷媒は図１１中の

破線矢印の方向に循環し、室内熱交換器４１が蒸発器となって冷房が行われる。圧縮機１の回転数は、蒸発圧力が目標値に一致するように制御され、この蒸発圧力目標値は、例えば蒸発温度Ｔｅが０℃となる圧力として求まる。非共沸混合冷媒の蒸発温度を、飽和蒸気温度と飽和液温度の平均値と定義すると、蒸発温度Ｔｅが０℃となる蒸発圧力目標値Ｐｅは、図１４に示すように、循環組成αにより一義的に定まる。従って制御装置２１では、予め図１４の関係式を記憶させておき、組成演算器２０から送信される循環組成信号を用いて、蒸発圧力目標値が演算される。さらに制御装置２１では、第１圧力検出器１２が検出する圧力と蒸発圧力目標値との差に応じて、ＰＩＤ制御等のフィードバック制御により圧縮機１の回転数の修正値が演算され、圧縮機回転数指令が圧縮機１に出力される。

【００５５】室外送風機３３の回転数は、凝縮圧力が目標値に一致するように制御され、この凝縮圧力目標値は、例えば凝縮温度Ｔｃが５０℃となる圧力として求まる。非共沸混合冷媒の凝縮温度を、飽和蒸気温度と飽和液温度の平均値と定義すると、凝縮温度Ｔｃが５０℃となる凝縮圧力目標値Ｐｃは、図１３に示すように、循環組成αにより一義的に定まる。従って制御装置２１では、予め図１３の関係式を記憶させておき、組成演算器２０から送信される循環組成信号を用いて、凝縮圧力目標値が演算される。さらに制御装置２１では、第２圧力検出器１４が検出する圧力と凝縮圧力目標値との差に応じて、ＰＩＤ制御等のフィードバック制御により室外送風機３３の回転数の修正値が演算され、室外送風機回転数指令が室外送風機３３に出力される。

【００５６】電気式膨張弁３の開度は、室内熱交換器４１の出口部の過熱度が所定の値、例えば５℃となるように制御される。この過熱度は、室内熱交換器４１内の圧力における飽和蒸気温度と室内熱交換器４１の出口部の温度との差として求めることができ、飽和蒸気温度は図１５に示した飽和液温度と同様に圧力と循環組成の関数として求めることができる。従って制御装置２１では、予め飽和蒸気温度と圧力と循環組成の関係式を記憶させておき、組成演算器２０から送信される循環組成信号と第１圧力検出器１２から送信される圧力信号、及び第４温度検出器４３から送信される温度信号を用いて、飽和蒸気温度、及び室内熱交換器４１の出口部過熱度が演算される。さらに制御装置２１では、この出口部過熱度と所定値（５℃）との差に応じて、ＰＩＤ制御等のフィードバック制御により電気式膨張弁３の開度の修正値が演算され、電気式膨張弁開度指令が電気式膨張弁３に出力される。

【００５７】次に、比較演算手段２２の動作について説明する。比較演算手段２２は、組成演算器２０から循環組成信号を取り込み、この循環組成が、予め記憶された適正循環組成範囲内であるか否かを判定し、循環組成が適正循環組成範囲内であれば、そのまま運転は続行される。一方、循環組成が使用中に冷媒漏れによって変化したり、冷媒充填時の誤動作で循環組成が変化した場合には、比較演算手段２２では、この循環組成が、予め記憶された適正循環組成範囲外であると判定すると、警報信号を警報装置２３へ送信する。この警報信号を受けた警報装置２３では、警告を所定時間発信して、冷凍空調装置の非共沸混合冷媒の循環組成が、適正範囲から外れていることを警告する。

【００５８】以上のように、本実施例に示すものでは、冷房、暖房にかかわらず、常に第２膨張弁の下流側が低圧の二相状態になるので、冷房時においても、暖房時においても同一の検出器で温度、及び圧力を計測でき、冷媒組成を演算することができる。従って、冷暖房別に検出器を設ける必要がなく装置構成が簡単となり、かつ循環組成が変化しても、常に最適な運転が可能となる。

【００５９】なお、本実施例では、暖房運転時の室外送風機３３の回転数を、第１圧力検出器１２の値が、循環組成から演算される蒸発圧力目標値と一致するように制御するものについて説明したが、室外熱交換器３３の入口部に温度検出器を設け、この温度が所定の値（例えば０℃）となるように制御しても、同様の効果を得ることができる。

【００６０】また本実施例では、冷房運転時の電気式膨張弁３の開度を、室内熱交換器４１の出口部の過熱度が所定の値（例えば５℃）となるように制御するものについて説明したが、室内熱交換器４１の出入口温度差が所定の値（例えば１０℃）となるように、すなわち第４温度検出器と第３温度検出器の差温が所定の値となるように制御しても、同様の効果を得ることができる。

【００６１】さらに本実施例では、１台の室外機３０に２台の室内機４０が接続された、冷凍空調装置で説明したが、これに限るものではなく、１台の室内機のみが接続されたものや、３台以上の室内機が接続されたものであっても、同様の効果を得ることができる。

【００６２】実施例６．図１６、及び図１７は本発明に係わる冷凍空調装置の第６の実施例を示すもので、図１１と図１６で、同じ番号の要素は同一要素を示している。冷媒は、暖房運転時には図１６中の実線矢印の方向に循環し、冷房運転時には破線矢印の方向に循環する。この実施例では、組成演算器２０に入力される信号は、第１温度検出器１１と第１圧力検出器１２のみであり、バイパス配管５０の毛細管５１に流入する冷媒乾き度Ｘを、例えば暖房運転時には０．１、冷房運転時には０．２と仮定して、第１温度検出器１１と第１圧力検出器１２からの信号のみで、循環組成を演算する。以下、制御装置２１、及び比較演算手段２２の動作は実施例５と同様である。

【００６３】従って、本実施例による冷凍空調装置は、実施例２と同様、組成演算器２０での演算が簡単にな

り、簡単な装置構成で実施例５と同様の装置が実現でき、安価となる。

【００６４】実施例７．図１８、及び図１９は本発明に係わる冷凍空調装置の第７の実施例を示すもので、図１１と図１８で、同じ番号の要素は同一要素を示している。冷媒は、暖房運転時には図１８中の実線矢印の方向に循環し、冷房運転時には破線矢印の方向に循環する。バイパス配管５０には、第２膨張弁として、第２電気式膨張弁５１が設けられており、この弁開度は、制御装置２１により制御される。またバイパス配管５０の途中には、室外熱交換器３２と第１電気式膨張弁３とを接続する配管（主配管）と熱交換を行う熱交換部５２が設けられており、バイパス配管５０を流れる冷媒のもつエンタルピーを主配管を流れる冷媒へ伝達するので上記エンタルピーが回収され、エネルギーロスを防いでいる。さらにこの熱交換部５２の出口部には、第５温度検出器１６が設けられ、この検出信号は制御装置２１に送られる。

【００６５】本実施例における制御装置２１では、バイパス配管５０に設けた第２電気式膨張弁５１の制御法のみが、実施例６と異なるため、この第２電気式膨張弁５１の制御法について説明する。第２電気式膨張弁５１の開度は、バイパス配管５０に設けられた熱交換部５２の出入口部の温度差が所定の値（例えば１０℃）となるように制御される。すなわち、バイパス配管５１に設けられた第１温度検出器１１と第５温度検出器１６の信号が制御装置２１に送信され、制御装置２１ではこの第１温度検出器１１と第５温度検出器１６が検出した温度の差を演算し、この温度差と所定値（例えば１０℃）との差に応じて、ＰＩＤ制御等のフィードバック制御により第２電気式膨張弁５１の開度の修正値が演算され、電気式膨張弁開度指令が第２電気式膨張弁５１に出力される。このようにすることにより、バイパス配管５０からアキュムレータ５にいく冷媒が常に蒸気の状態となり、エネルギーが有効に使われ、かつ圧縮機１への液戻りも防げる効果がある。

【００６６】なお、上記実施例では、第２膨張弁５１として電気式膨張弁を用いた場合について説明したが、毛細管などでもよい。

【００６７】実施例８．図２０、及び図２１は本発明に係わる冷凍空調装置の第８の実施例を示すもので、図１８と図２０で、同じ番号の要素は同一要素を示している。冷媒は、暖房運転時には図２０中の実線矢印の方向に循環し、冷房運転時には破線矢印の方向に循環する。この実施例では、組成演算器２０に入力される信号は、実施例２、及び実施例６と同様、第１温度検出器１１と第１圧力検出器１２のみであり、バイパス配管５０の第２電気式膨張弁５１に流入する冷媒乾き度Ｘを、例えば暖房運転時には０．１、冷房運転時には０．２と仮定して、第１温度検出器１１と第１圧力検出器１２からの信号のみで、循環組成を演算する。以下、制御装置２１、及び比較演算手段２２の動作は実施例７と同様である。

【００６８】なお、上記実施例では、第２膨張弁５１として電気式膨張弁を用いた場合について説明したが、毛細管などでもよい。

【００６９】また、上記実施例５ないし実施例８では、アキュムレータ５を有する冷凍空調装置を示したが、無いものでもよい。この場合、バイパス配管５０は圧縮機の吸入配管と主配管とを第２膨張弁を介して接続する構成となる。さらに、上記実施例５ないし実施例８では、比較演算手段２２が接続されており、循環組成が所定範囲から外れた場合には、警告信号を警報装置２３に送信するように構成されているが、これら比較演算手段２２、及び警報装置２３を設けなくてもよい。また、実施例１ないし実施例４に対し、上記比較演算手段２２、及び警報装置２３を設けてもよい。

【００７０】

【発明の効果】以上のように本発明の請求項１によれば、非共沸混合冷媒を用い、圧縮機、凝縮器、膨張弁、及び蒸発器を連結して冷凍サイクルを構成する冷凍空調装置において、蒸発器入口部の冷媒の温度と圧力、及び凝縮器出口部の冷媒温度を検出してサイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたので、サイクル内の循環組成が変化しても、常に最適な運転が可能となる。

【００７１】また、本発明の請求項２によれば、非共沸混合冷媒を用い、圧縮機、凝縮器、膨張弁、及び蒸発器を連結して冷凍サイクルを構成する冷凍空調装置において、蒸発器入口部の冷媒の温度と圧力を検出してサイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたので、簡単な装置構成で、上記装置と同様の効果がある。

【００７２】また、本発明の請求項３によれば、非共沸混合冷媒を用い、圧縮機、凝縮器、膨張弁、蒸発器、及びアキュムレータを連結して冷凍サイクルを構成する冷凍空調装置において、アキュムレータ内、あるいはアキュムレータと圧縮機吸入配管との間の冷媒の温度と圧力を検出してサイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたので、簡単な装置構成で、上記装置と同様の効果がある。

【００７３】また、本発明の請求項４によれば、非共沸混合冷媒を用い、圧縮機、凝縮器、膨張弁、蒸発器、及びアキュムレータを連結して冷凍サイクルを構成する冷凍空調装置において、アキュムレータの液面を検出してサイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成

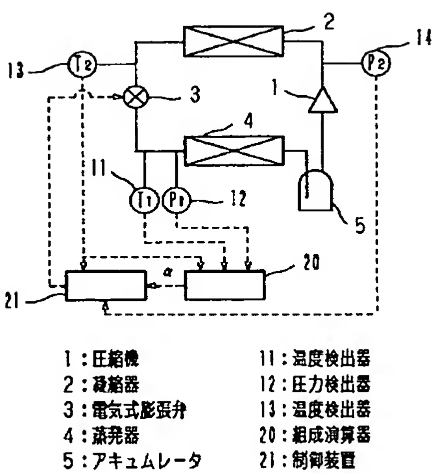
成に応じて冷凍サイクルの運転制御を行う制御装置を設けたので、簡単な装置構成で、上記装置と同様の効果がある。
【００７４】また、本発明の請求項５によれば、非共沸混合冷媒を用い、圧縮機、四方弁、第１熱交換器、第１膨張弁、及び第２熱交換器を連結して冷凍サイクルを構成する冷凍空調装置において、第１熱交換器と第１膨張弁の間の配管と、圧縮機の吸入配管とを第２膨張弁を介してバイパス配管で接続し、第２膨張弁の出口部の冷媒の温度と圧力、及び第２膨張弁の入口部の冷媒温度を検出して、サイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたので、サイクル内の循環組成が変化しても、常に最適な運転が可能となる。
【００７５】また、本発明の請求項６によれば、非共沸混合冷媒を用い、圧縮機、四方弁、第１熱交換器、第１膨張弁、及び第２熱交換器を連結して冷凍サイクルを構成する冷凍空調装置において、第１熱交換器と第１膨張弁の間の配管と、圧縮機の吸入配管とを第２膨張弁を介してバイパス配管で接続し、第２膨張弁の出口部の冷媒の温度と圧力を検出して、サイクル内を循環する冷媒組成を演算する組成演算器を設けると共に、この組成演算器により検出された循環組成に応じて冷凍サイクルの運転制御を行う制御装置を設けたので、簡単な装置構成で、上記装置と同様の効果がある。
【００７６】また、本発明の請求項７によれば、非共沸混合冷媒を用い、圧縮機、四方弁、第１熱交換器、第１膨張弁、及び第２熱交換器を連結して冷凍サイクルを構成する上記冷凍空調装置において、バイパス配管に、第１熱交換器と第１膨張弁の間の配管とで熱交換を行う熱交換部を設けたので、サイクル内の循環組成が変化しても、常に最適な運転が可能となるとともに、エネルギー効率の高い冷凍空調装置が得られる。
【００７７】また、本発明の請求項８によれば、上記各冷凍空調装置において、組成演算器で検出された循環組成が所定範囲から外れた場合に警告信号を発する比較演算手段と、この比較演算手段が発する警報信号によって動作する警報装置を設けたので、安全性や信頼性の高い冷凍空調装置の提供が可能となる。
【図面の簡単な説明】
【図１】本発明の実施例１による非共沸混合冷媒を用いた冷凍空調装置を示す構成図である。
【図２】本発明の実施例１に係わる組成演算器の動作を示すフローチャートである。
【図３】本発明の実施例１に係わる組成演算器の動作を圧力－エンタルピー線を用いて説明する説明図である。
【図４】本発明の実施例１に係わる組成演算器の動作を非共沸混合冷媒の温度と循環組成との関係を用いて説明する説明図である。
【図５】本発明の実施例１に係わる制御装置の動作を示すフローチャートである。
【図６】本発明の実施例２による非共沸混合冷媒を用いた冷凍空調装置を示す構成図である。
【図７】本発明の実施例３による非共沸混合冷媒を用いた冷凍空調装置を示す構成図である。
【図８】本発明の実施例３に係わる組成演算器の動作を非共沸混合冷媒の温度と循環組成との関係を用いて説明する説明図である。
【図９】本発明の実施例４による非共沸混合冷媒を用いた冷凍空調装置を示す構成図である。
【図１０】本発明の実施例４に係わる組成演算器の動作をアキュムレータ内の冷媒液面高さと循環組成との関係を用いて説明する説明図である。
【図１１】本発明の実施例５による非共沸混合冷媒を用いた冷凍空調装置を示す構成図である。
【図１２】本発明の実施例５による非共沸混合冷媒を用いた冷凍空調装置の制御ブロック図である。
【図１３】本発明の実施例５に係わる制御装置の動作を非共沸混合冷媒の凝縮圧力と循環組成との関係を用いて説明する説明図である。
【図１４】本発明の実施例５に係わる制御装置の動作を非共沸混合冷媒の蒸発圧力と循環組成との関係を用いて説明する説明図である。
【図１５】本発明の実施例５に係わる制御装置の動作を非共沸混合冷媒の飽和液温度と圧力と循環組成との関係を用いて説明する説明図である。
【図１６】本発明の実施例６による非共沸混合冷媒を用いた冷凍空調装置を示す構成図である。
【図１７】本発明の実施例６による非共沸混合冷媒を用いた冷凍空調装置の制御ブロック図である。
【図１８】本発明の実施例７による非共沸混合冷媒を用いた冷凍空調装置を示す構成図である。
【図１９】本発明の実施例７による非共沸混合冷媒を用いた冷凍空調装置の制御ブロック図である。
【図２０】本発明の実施例８による非共沸混合冷媒を用いた冷凍空調装置を示す構成図である。
【図２１】本発明の実施例８による非共沸混合冷媒を用いた冷凍空調装置の制御ブロック図である。
【図２２】従来の非共沸混合冷媒を用いた冷凍空調装置を示す構成図である。
【符号の説明】

１	圧縮機	２	凝縮器
３	電気式膨張弁	４	蒸発器
５	アキュムレータ	１１	温度検出器
１２	圧力検出器	１３	温度検出器
１４	圧力検出器	１５	液面検出器
１６	温度検出器	２０	組成演算器
２１	制御装置	２２	比較演算器
２３	警報装置	３１	四方弁

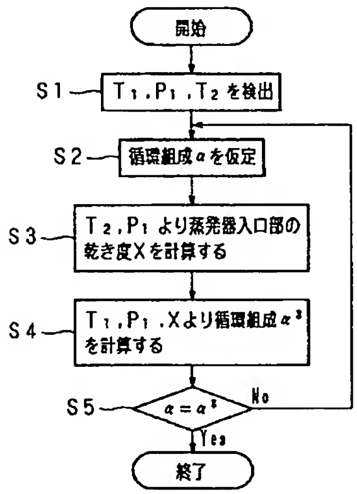
３２ 室外熱交換器 ４１ 室内熱交換器
４２ 温度検出器 ４３ 温度検出器＊

＊５０ バイパス配管 ５１ 第２膨張弁
５２ 熱交換部

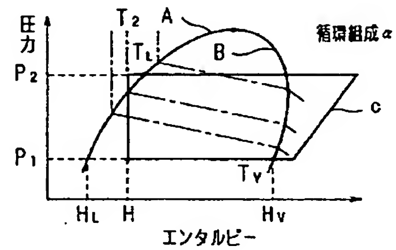
【図１】



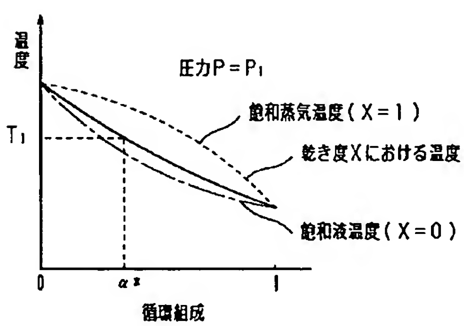
【図２】



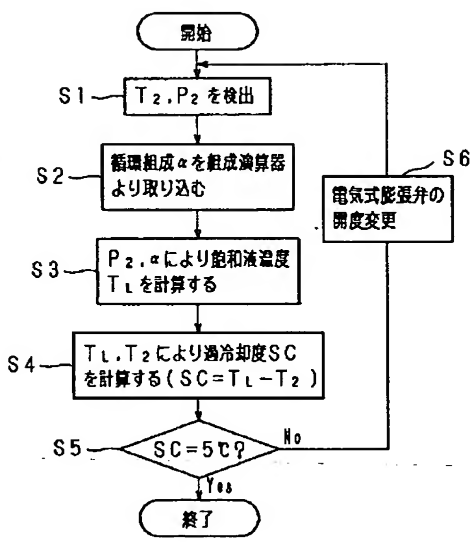
【図３】



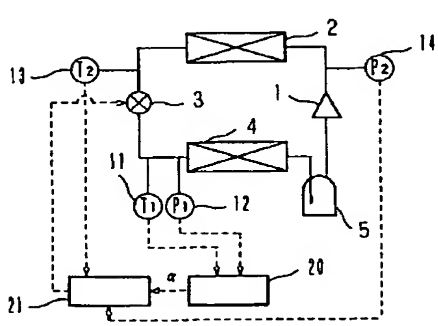
【図４】



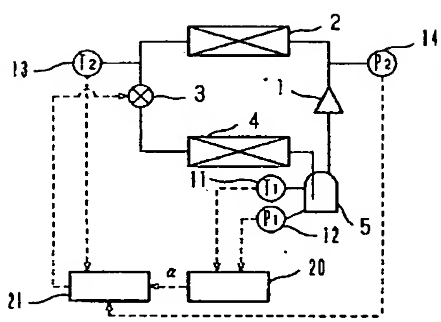
【図５】



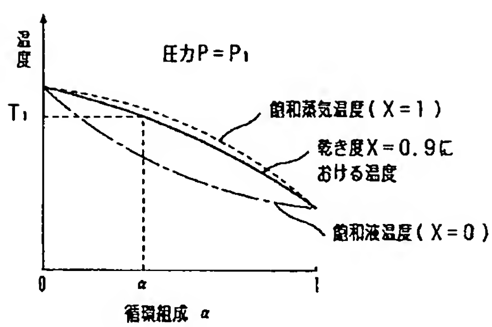
【図６】



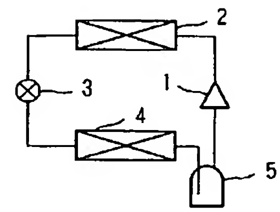
【図７】



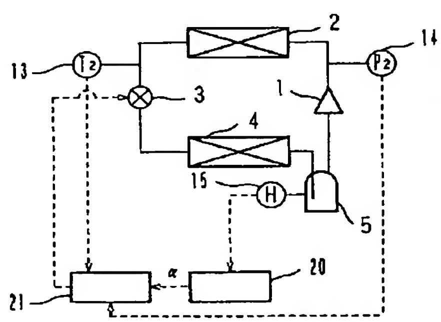
【図８】



【図２２】

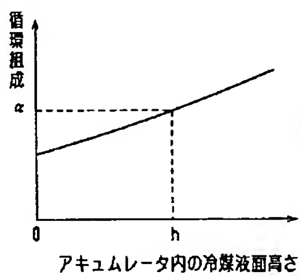


【図９】

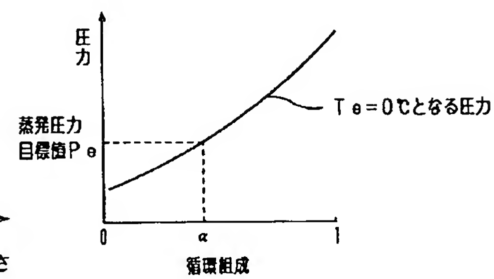


15：液面検出器

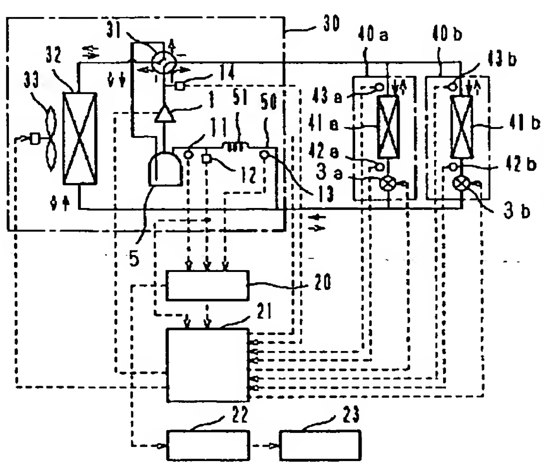
【図１０】



【図１４】

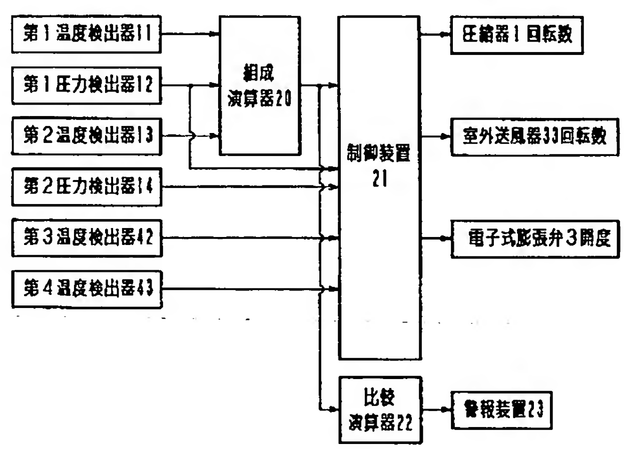


【図１１】

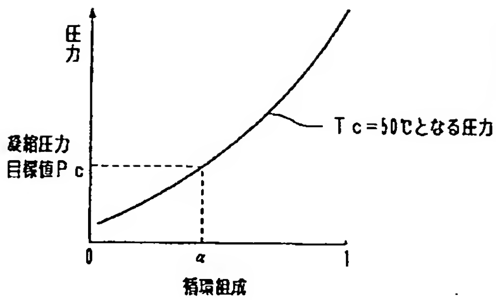


３ａ，３ｂ：第１膨張弁
22：比較演算器
23：警報装置
31：四方弁
32：室外熱交換器
41ａ，41ｂ：室内熱交換器
50：バイパス配管
51：第２膨張弁

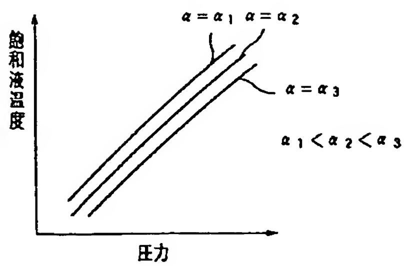
【図１２】



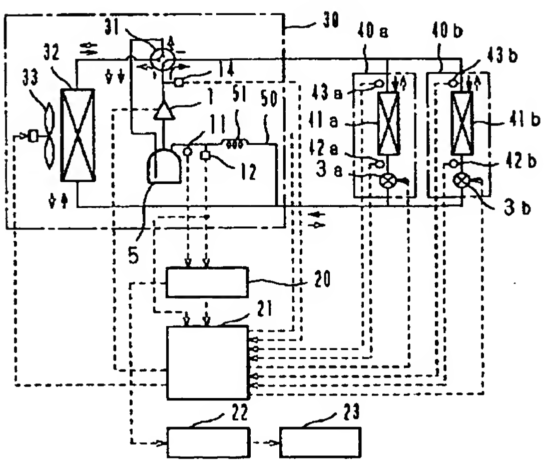
【図１３】



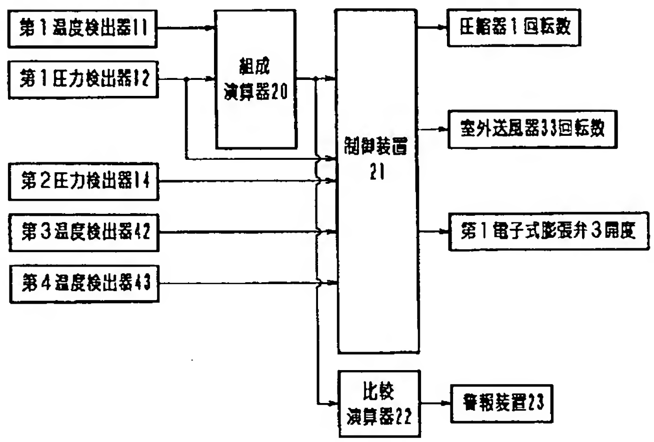
【図１５】



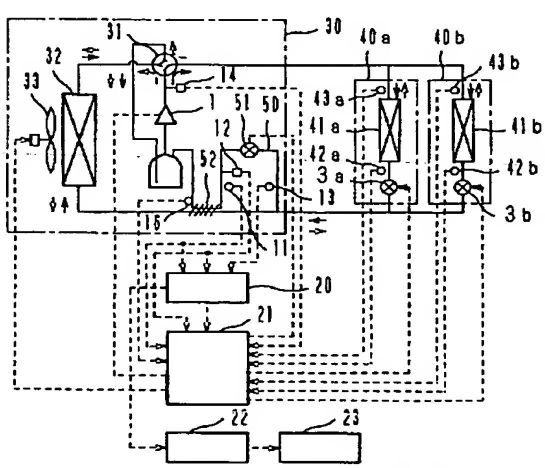
【図１６】



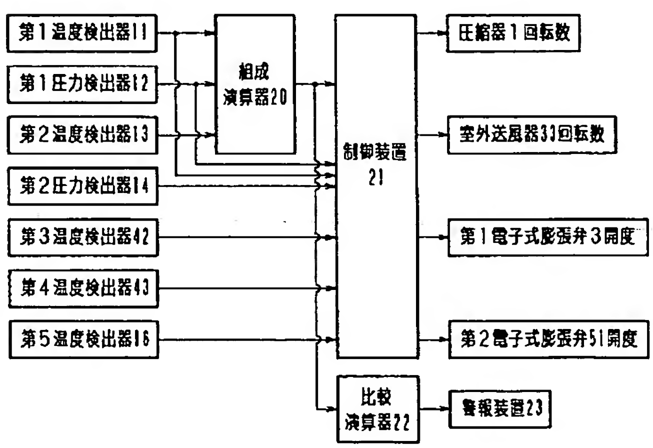
【図１７】



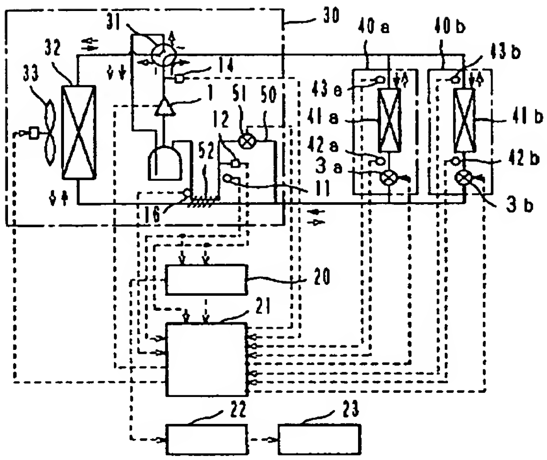
【図１８】



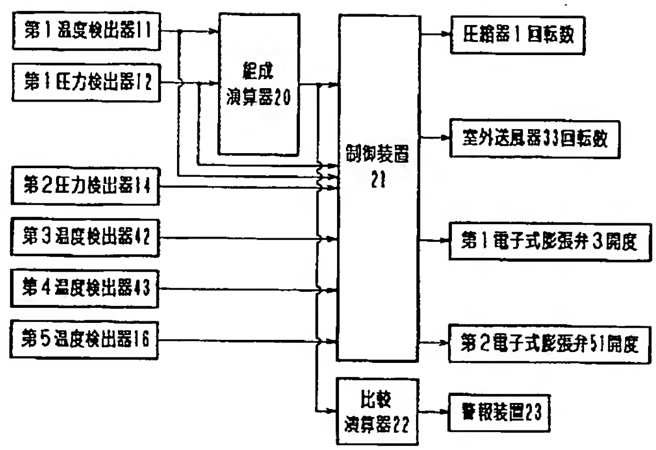
【図１９】



【図２０】



【図２１】



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